

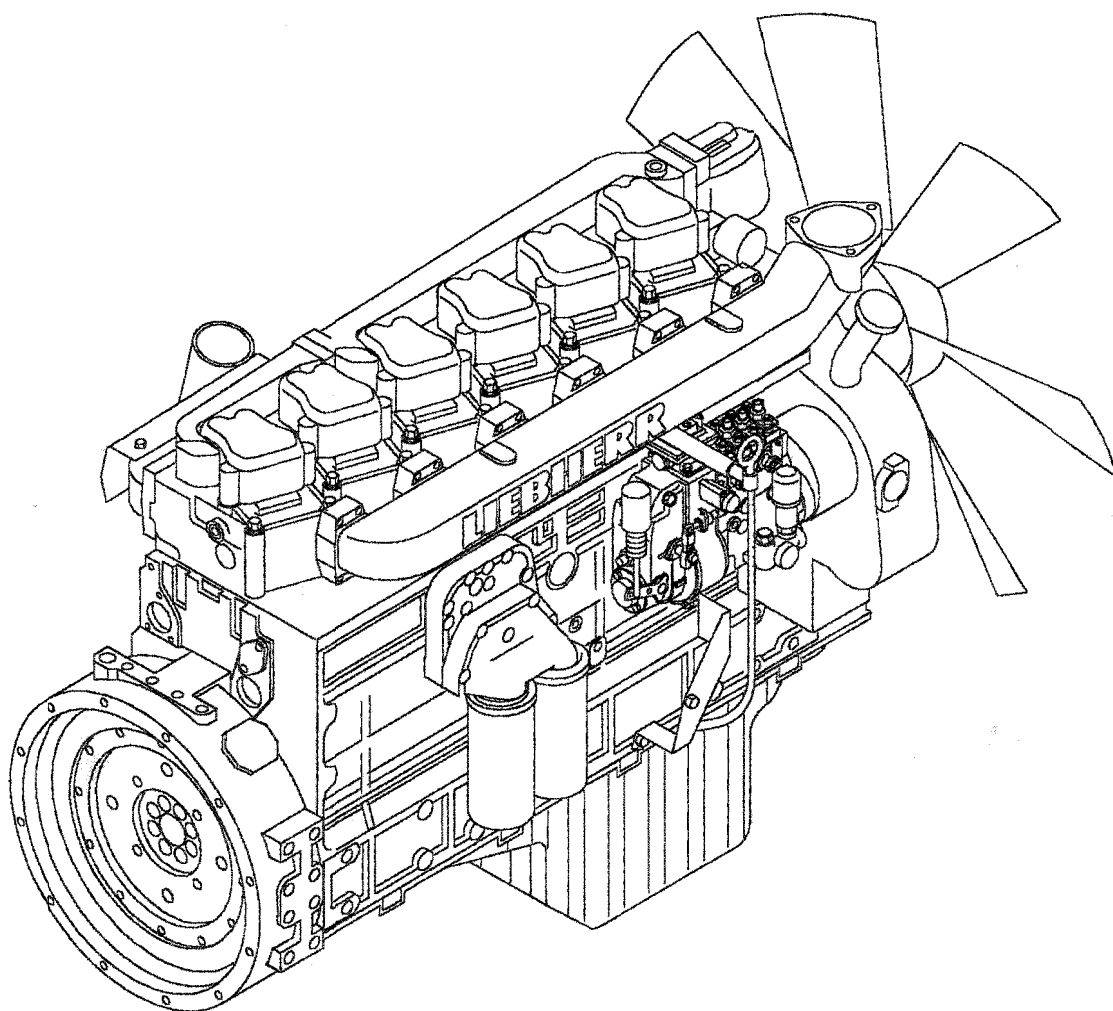
# **Service Manual**

**LIEBHERR**  
**Diesel engines**

**D 904 / 906**

**D 914 / 916**

**D 924 / 926**



# Foreword

This manual includes the major points for proper maintenance, adjustments and repairs with technical data and screw tightening torques for Liebherr Diesel engine D 904 / 906 / 914 / 916 / 924 / 926.

These tasks must be carried out by trained professionals.

The Service manual will not be updated. For that reason, we always refer to additional Service Information bulletins. All changes will be incorporated when the Service manual is reissued periodically.

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This Service manual was written by **Liebherr-Machines-Bulle S.A., Dept. Service – Diesel - Engine** and issued by the **Service Dept., Liebherr Hydraulikbagger GmbH, Kirchdorf/Ilser, Dept. VS.**

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LIEBHERR-MACHINES-BULLE SA  
Dept.: Service – Diesel – Engine

Issue:  
12 / 2003

Id. No.  
8718458 (English)

## Index

- 1) Engine illustrations
- 2) Technical description
- 3) Engine description, engine data tag, cylinder description, direction of rotation and engine identification number
- 4) Engine data, adjustment values, operating pressures, operating temperatures and fluid quantities
- 5) Torque specifications
- 6) Valve adjustment
- 7) Cylinder head gaskets
- 8) Cylinder head
- 9) Cylinder liner
- 10) Piston and connecting rod
- 11) Check piston clearance
- 12) Crankshaft and bearing
- 13) Camshaft and valve drive
- 14) Lubrication circuit
- 15) Oil pans
- 16) Lube oil pump
- 17) Lube oil filter and oil cooler
- 18) Coolant circuit
- 19) Water filter
- 20) Coolant pump
- 21) Fan drive
- 22) Fuel system
- 23) Fuel pump
- 24) Fuel filter
- 25) Injection pump
- 26) Injection pump drive, adjust begin of delivery
- 27) Fuel injector
- 28) Engine exhaust
- 29) Fan and flywheel side crankshaft seal
- 30) Hydraulic pump auxiliary drive
- 31) Air compressor
- 32) Starter
- 33) Air conditioner compressor and alternator
- 34) Starting aid
- 35) Turbo charger
- 36) Gear drive
- 37) Maintenance and inspection
- 38) Service fluids
- 39) Troubleshooting
- 40) Special tools

## **1 Engine illustrations**

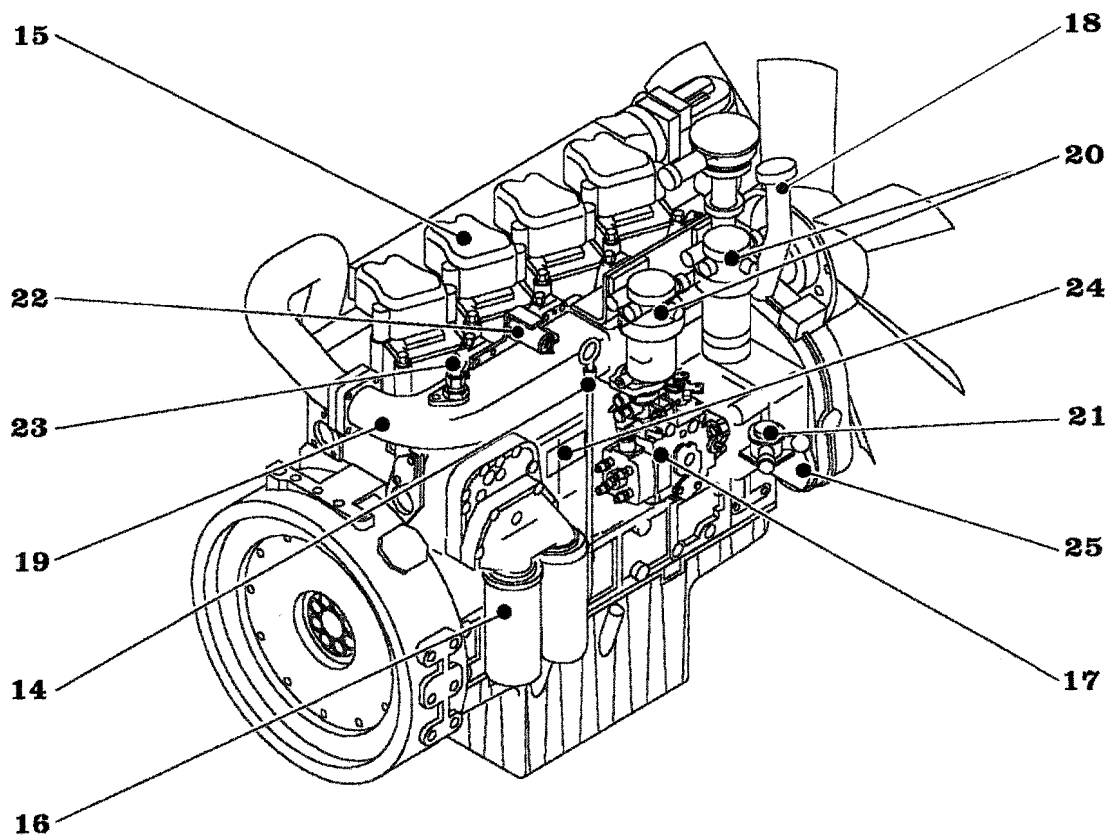
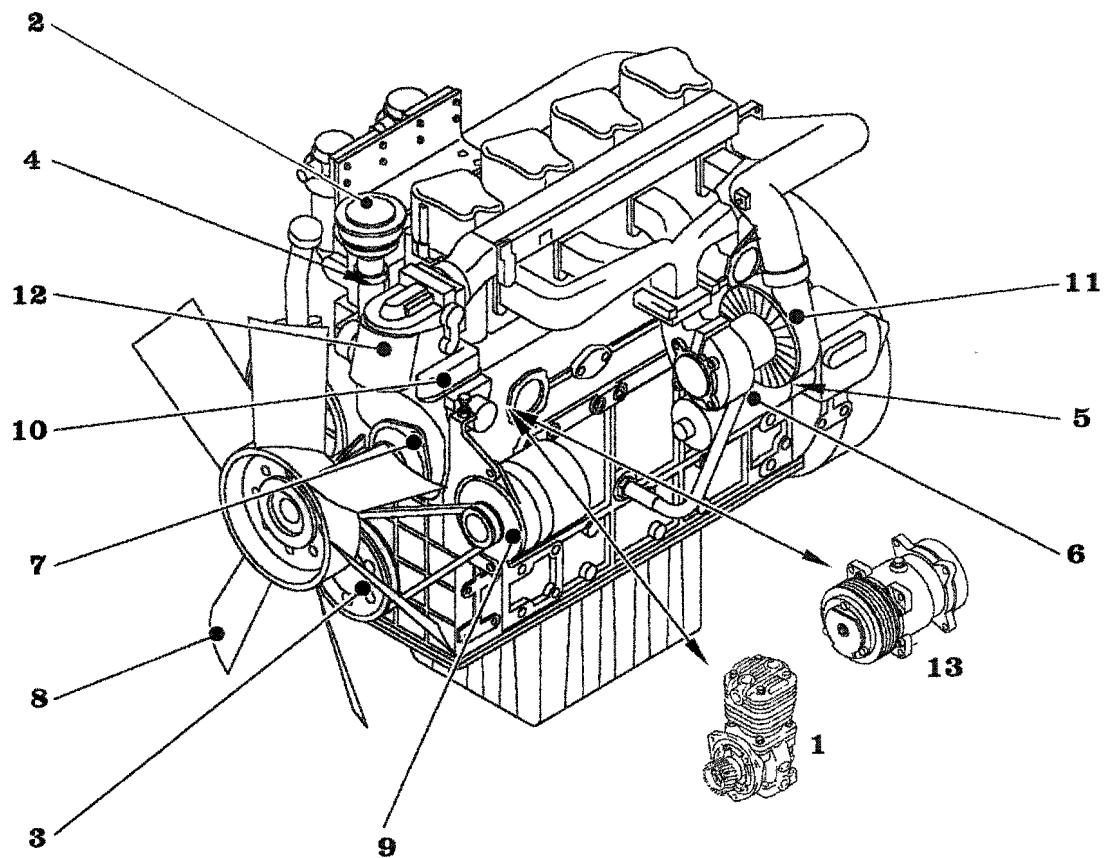
**Engine view: Left, as seen from the flywheel side onto the engine**

- 1 Air compressor**
- 2 Oil separator**
- 3 V-belt - crankshaft**
- 4 Coolant temperature sensor**
- 5 Oil pressure sensor (with warning contact)**
- 6 Starter**
- 7 Coolant pump**
- 8 Fan**
- 9 Alternator**
- 10 Coolant thermostat**
- 11 Exhaust turbocharger**
- 12 Water filter**
- 13 Air conditioner compressor**

**Engine view: Right, as seen from the flywheel side onto the engine**

- 14 Oil dipstick**
- 15 Valve cover**
- 16 Oil filter**
- 17 Injection pump**
- 18 Oil filler neck**
- 19 Suction pipe**
- 20 Fuel filter**
- 21 Fuel pump**
- 22 Solenoid valve (flame glow plug)**
- 23 Flame glow plug**
- 24 Data tag**
- 25 Hydraulic pump auxiliary drive**





**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /

**Engine illustration**

Typ	D 904 / 914 / 924
Model	D 906 / 916 / 926
Type	
Blatt	1
Page	
Feuille	

## **2 Technical description**

### **Engine design**

Water-cooled, 4 and 6 cylinder in-line engines with LIEBHERR direct injection process and exhaust turbocharger.

### **Characteristics**

A sturdy basic construction and generous dimensions provide the foundation for high operating safety and long service life. Low fuel consumption, low noise and exhaust emissions are achieved through a combustion process, which is specially adapted to requirements. Low maintenance effort on easily accessible components and a variety of optional accessories ensure good overall efficiency.

### **Power transmission**

The 4 cylinder engines feature a steel crankshaft with 5 bearings, the 6 cylinder engines 7 bearings, with inductively hardened bearing surfaces and 8 / 12 forged counterweights. A vibration damper is installed on the fan side on the crankshaft. Forge-pressed, split connecting rod, leaded bronze tri-metal sliding bearings or sputter bearings, smooth shaft three ring piston of aluminum alloy with ring support and combustion recess in the piston base. Exchangeable, wet cylinder liners

### **Housing**

The crankcase is made in one unit of alloy cast iron. Single cylinder heads with integrated intake channel and removable / exchangeable valve seat rings and valve guides. Flywheel housing, front timing case and oil pan on the underside close off the engine.

### **Engine timing**

Per cylinder one intake and exhaust valve each, suspended in the cylinder head (ohv.). Actuated by a steel camshaft with 5 or 7 bearings via steel tappets, push rod and rocker arm. Drive of camshaft, injection pump, lube oil pump, air compressor, coolant pump, and auxiliary hydraulic pumps by the crankshaft via nitride gears on the fan side.

### **Lubrication**

Force-feed lubrication with gear pump for crankshaft, connecting rod and camshaft bearings as well as piston pin bushing, tappet and rocker arm. Oil filtration via two replaceable filter elements in the main oil circuit. Auxiliary components as well as injection pump and air compressor are connected to engine lubrication circuit. The engine oil cooler is integrated in the coolant flow.

### **Cooling**

Dual thermostatically regulated fluid cooling with rotary pump. Individual supply of each cylinder unit via distributor channels integrated in the crankcase. Piston cooling through oil spray from engine lubrication circuit.

### **Fuel injection system and regulation**

Maintenance free BOSCH in line injection pump or distributor pump with mechanical BOSCH centrifugal regulator. On A4, A5 - engines with „EDC“ control (electronic regulation), fuel pump with fuel filter, BOSCH four or six hole nozzles.

### **Flame starter**

The flame starter is a cold starting assistance for low ambient temperature. It minimizes the emission of white smoke after starting the diesel engine. By reducing the starting period, the starter and the batteries will be saved.

The flame spark plug, mounted in the air intake, will get fuel via a solenoid valve with dosaging nozzle and could set free.

### **Electrical equipment**

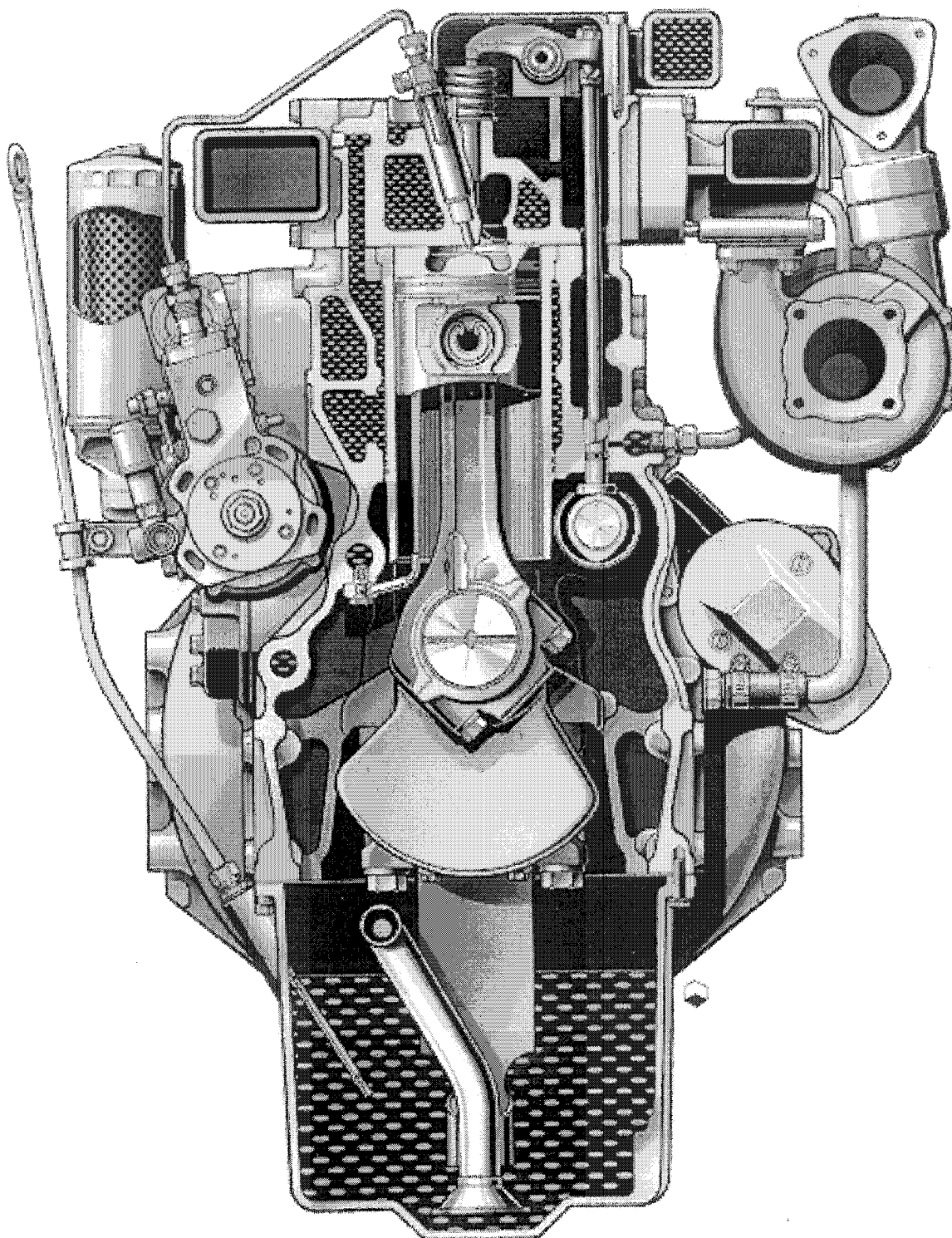
Starter and alternator: 24 Volt

### **Electronic sensors controlling the engine parameters**

Air charge pressure sensor, temperature sensor at cooling agent and air charge, rotation sensor and oil pressure sensor are indicators for the external control functions. Each function and error signal is described in the corresponding user manual.

<b>LIEBHERR</b>  Datum / Edition / Date 12 / 2003	Benennung / Description /  <b>Technical description</b>	Typ Model D 904 / 914 / 924 Type D 906 / 916 / 926  Blatt Page 2 Feuille
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## Cross section



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /

## Technical description

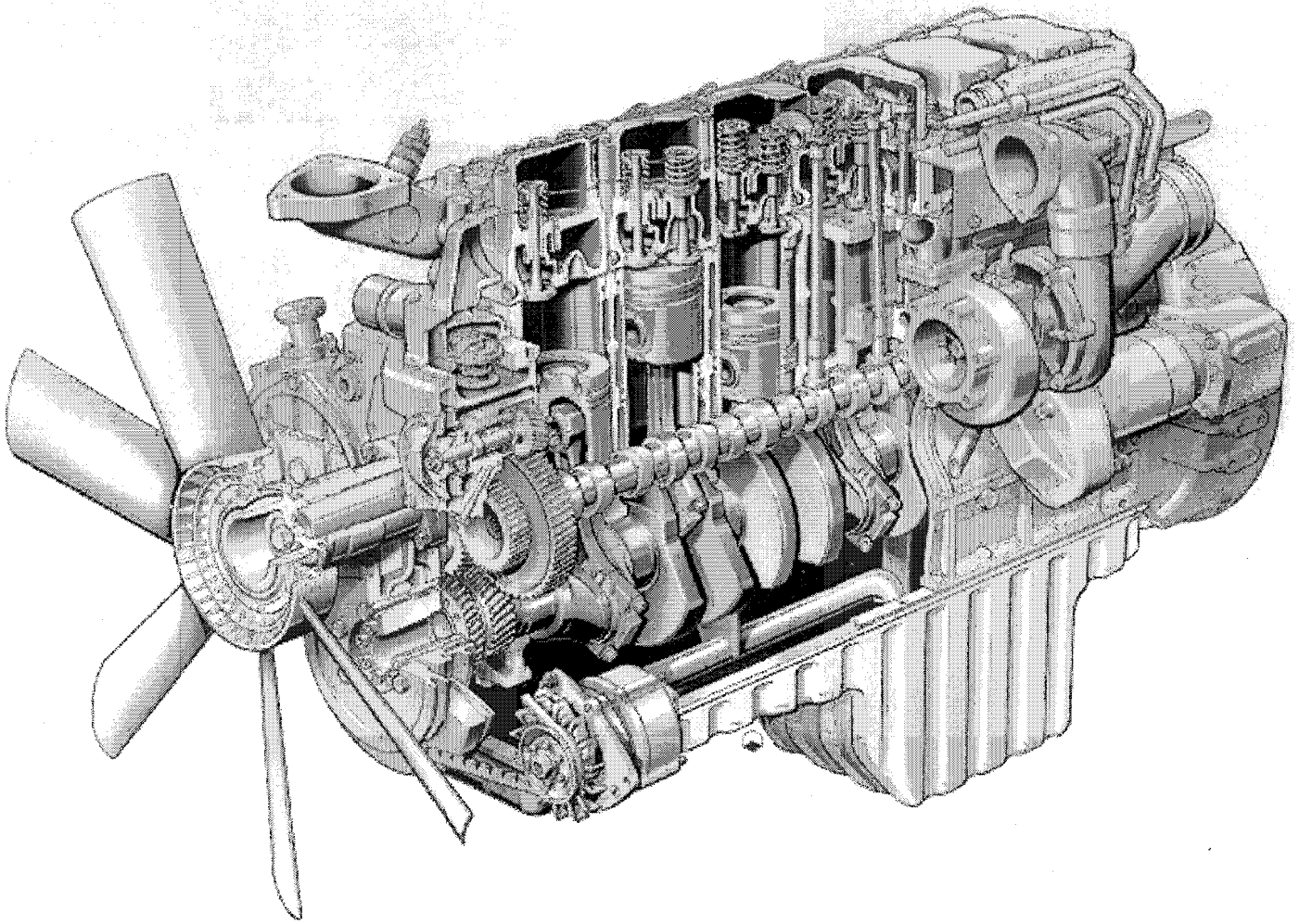
Typ  
Model  
Type

D 924 / 926 T/TI-E

Blatt  
Page  
Feuille

2

## Length section



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /

**Technical description**

Typ  
Model  
Type

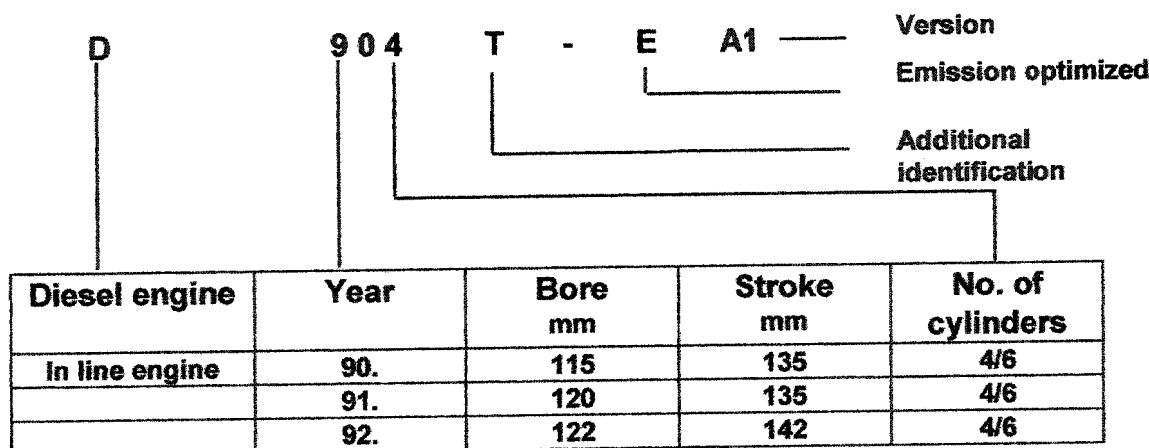
**D 926 T/TI-E**

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Page  
Feuille

**2.1**

### 3 Engine description, engine data tag, cylinder description, direction of rotation and engine identification number

#### Engine description:



**Additional identification:** NA = naturally aspirated engine, TB = „moderately“ turbo-charged engine, T = Turbo-charged engine, TI = Turbo-charged and inter-cooled

#### Version:

- A1 = Distributor type injection pump
- A2 = MW-/P3000- injection pump
- A3 = P7100- injection pump
- A4 = P7100+“EDC”(electronic regulation)
- A5 = H-RP43- Control-sleeve injection pump + EDC (Electronic regulation)

#### Engine data tag:

The engine data tag is installed on the right side of the crankcase, as seen from the flywheel, above the injection pump. On some engine versions, an additional second data tag is installed on the air intake pipe.

<b>Data:</b>	<b>Type</b>	=	<b>D914T, D926TI etc.</b>
	<b>Mot. Nr.</b>	=	<b>Engine number</b>
	<b>Code</b>	=	<b>Inspection (performance) number</b>
	<b>kW</b>	=	<b>Performance in kW</b>
	<b>1/min.</b>	=	<b>Nominal engine RPM</b>
	<b>Lieferumfang</b>	=	<b>Id. No. of engines</b>

In addition, the engine performance standard is noted in the lower left field.

#### Additional data tag:

For additional data, an additional data tag may be installed .

<b>Data:</b>	<b>Code</b>	=	<b>Inspection (performance) number</b>
	<b>Field 1</b>	=	<b>EU member number</b>
	<b>Field 2</b>	=	<b>Inspection number per ECE regulation R24 or</b>
<b>R49</b>	<b>Field 3</b>	=	<b>Approval number</b>

### Engine data tag

LIEBHERR			
TYP	<input style="width: 90%;" type="text"/>	MOT.NR	<input style="width: 90%;" type="text"/>
CODE	kw	1/min	LIEFERUMFANG
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

### Additional data tag

LIEBHERR		
CODE	<input style="width: 70%;" type="text"/>	
1	2	3
1	2	3
<input style="width: 100%;" type="text"/>		

<b>LIEBHERR</b>  Datum / Edition / Date 12 / 2003	Benennung / Description /	Typ Model Type	D 904 / 914 / 924 D 906 / 916 / 926
	Engine description, data tag, cylinder description, turning direction and engine identification number	Blatt Page Feuille	3

### **3.1 Engine description, engine data tag, cylinder description, direction of rotation, and engine identification number**

**Engine data tag for „E“ (emission optimized) engines from 1997:**

**Note:**

The text on the engine data tags on the engines is in English.  
For clarification, the text is translated in German for the Service Manual.

**Cylinder description, direction of rotation:**

Cylinder 1 is located on the flywheel side. The cylinder numbers are cast into the upper side of the crankcase when viewed from the flywheel, as is the firing order. The direction of rotation is to the left, viewed from the flywheel.

**Engine number:**

The engine number is engraved into the data tag and in the crankcase. The engine number is on the crankcase, on the left hand side on the top after the last cylinder, as seen from the flywheel.

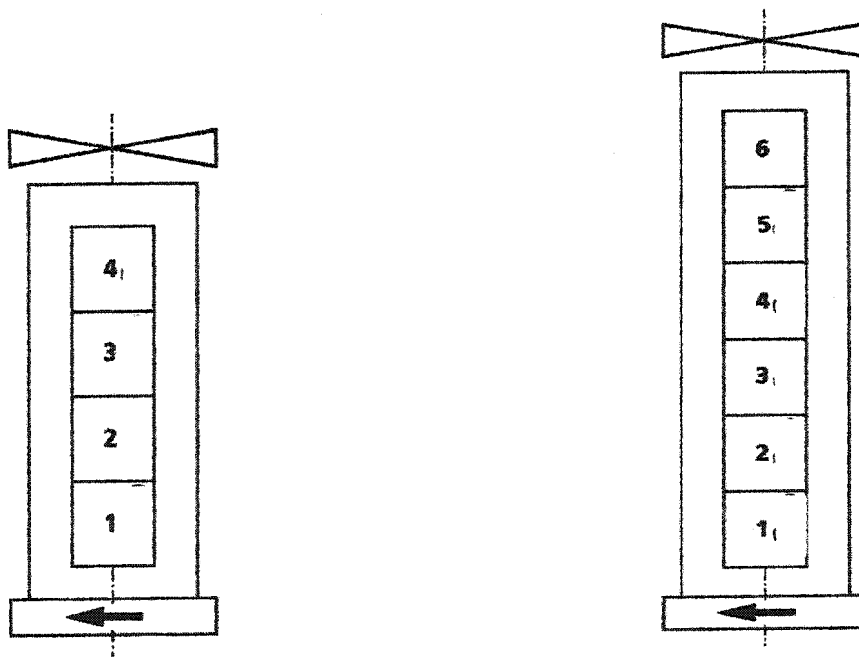
<b>Engine number - example:</b>	<b>2003</b>	<b>01</b>	<b>0050</b>
	Year	4 cylinder 02 = 6 cylinder	running number



IMPORTANT ENGINE INFORMATION			
ENGINE NUMBER <input style="width: 150px;" type="text"/>		MODEL <input style="width: 150px;" type="text"/>	
ENGINE DISPLACEMENT (LITERS) <input style="width: 150px;" type="text"/>		<input style="width: 150px;" type="text"/>	
INJECTION TIMING (DEGREES BTDC) <input style="width: 150px;" type="text"/>			
FUEL RATE (CUBIC mm/STROKE) <input style="width: 150px;" type="text"/>		<input style="width: 150px;" type="text"/>	
INTAKE VALVE LASH (mm) <input style="width: 150px;" type="text"/>		EXHAUST VALVE LASH (mm) <input style="width: 150px;" type="text"/>	
POWER HP <input style="width: 100px;" type="text"/>		CODE <input style="width: 100px;" type="text"/>	
POWER KW <input style="width: 100px;" type="text"/>		POWER KW <input style="width: 100px;" type="text"/>	
RPM <input style="width: 100px;" type="text"/>		RPM <input style="width: 100px;" type="text"/>	
ENGINE FAMILY <input style="width: 150px;" type="text"/>		<input style="width: 150px;" type="text"/>	
ENGINE CERTIFIED TO OPERATE ON			
COMMERCIAL AVAILABLE DIESEL FUEL			
THIS ENGINE CONFORMS TO <input style="width: 150px;" type="text"/>			
U.S. EPA AND CALIFORNIA ARB			
REGULATION FOR NONROAD			
COMPRESSION-IGNITION ENGINES.			
LIEBHERR MACHINES SULLE S.A.		MADE IN SWITZERLAND	

### Engine data tag

### Cylinder description Turning direction



**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

**Engine description, data tag, cylinder  
description, turning direction and  
engine identification number**

Typ  
Model  
Type

**D 904 / 914 / 924  
D 906 / 916 / 926**

Blatt  
Page  
Feuille

**3.1**

## Engine data: D 904 / 906

Working procedure:	:	Four cycle Diesel engine
Combustion procedure	:	Direct injection
Bore	:	115 mm
Stroke	:	135 mm
Total volume	:	D 904 = 5.6 dm <sup>3</sup> D 906 = 8.4 dm <sup>3</sup> (1.4 dm <sup>3</sup> per cyl.)
Nominal RPM	:	2000, 2100 1/min.
Compression ratio	:	D 904 NA / TB = 17.0:1 D 906 NA / TB = 17.0:1 D 904 T = 15.5:1 D 906 T = 15.5:1 D 906 TI = 15.5:1
Firing order	:	4 Cyl. = 1 - 3 - 4 - 2 6 Cyl. = 1 - 5 - 3 - 6 - 2 - 4
Firing distance in °KW	:	4 Cyl. = 180 - 180 - 180 - 180 = 720 6 Cyl. = 120 - 120 - 120 - 120 - 120 - 120 = 720

<b>LIEBHERR</b>	Benennung / Description /	Typ Model Type
Datum / Edition / Date 12 / 2003	Engine data, adjustment values, operating pressures, operating temperatures and fluid quantities	D 904 / 906
		Blatt Page Feuille 4

### Adjustment values:

Begin of delivery in °KW v. OT	: D 904 NA / TB, D 906 NA / TB	= 26±1
	: D 904 T, D 906 T / TI ( RQV-Regulator)	= 26±1
	: D 904 T, D 906 T / TI ( RSV-Regulator)	= 28±1
Valve play	: Intake cold	= 0.2 mm
	: Exhaust cold	= 0.25 mm

### Operating pressures:

Compression pressure	: D 904 NA / TB, D 906 NA / TB	= 20 - 28 bar
	: D 904 T, D 906 T / TI	= 18 - 26 bar
Injection pressure	: D 904 NA / TB, D 906 NA / TB	- New = 260 + <sup>8</sup> bar
		- Operating pr. = 252 + <sup>8</sup> bar
	: D 904 T, D 906 T/TI (RQV-Regulator)	- New = 225 + <sup>8</sup> bar
		- Operating pr. = 217 + <sup>8</sup> bar
	: D 904 T, D 906 T/TI (RSV-Regulator)	- New = 260 + <sup>8</sup> bar
		- Operating pr. = 252 + <sup>8</sup> bar
Minimum lube oil pressures at engine operating temperature:		at nominal RPM = 3.5 bar
		at 1400 <sup>1</sup> /min = 2.5 bar
		at 800 <sup>1</sup> /min = 1.5 bar

Minimum pressure in cooling system with engine at operating temperature: at nominal RPM = 1.1 bar  
(thermostats open) measured on the coolant pump outlet

### Operating temperatures:

Coolant temperature, maximum	: 100 °C
Thermostats - opening temperature	: 71 °C, 79 °C, 83 °C
Lube oil temperature, maximum	: 115 °C

### Oil quantities:

Lube oil in oil pan	: 4 cyl. = max /min	16 / 10 l	} depending on oil pan version
	: 6 cyl. = max /min	20 / 10 l	
		22,5 / 12 l	

Marks on dipstick are the determining factor.

<b>LIEBHERR</b>	Benennung / Description /	Typ Model	D 904 / 906
	Engine data, adjustment values, operating pressures, operating temperatures and oil quantities	Type	
Datum / Edition / Date 12 / 2003		Blatt Page Feuille	4.1

## Engine data : D 914 / 916

Working procedure	: Four cycle Diesel engine
Combustion procedure	: Direct injection
Bore	: 120 mm
Stroke	: 135 mm
Total volume	: D 914 = 6.1dm <sup>3</sup> D 916 = 9.2 dm <sup>3</sup> (1.525 dm <sup>3</sup> per cyl.)
Nominal RPM	: 1800, 2000, 2100 <sup>1</sup> /min
Compression ratio	: D 914 T / TI = 15. 9 : 1 D 916 T / TI = 15. 9 : 1
Firing order	: 4 cyl. = 1 - 3 - 4 - 2 6 cyl. = 1 - 5 - 3 - 6 - 2 - 4
Firing distance in ° KW	: 4 cyl. = 180 - 180 - 180 - 180 = 720 6 cyl. = 120 - 120 - 120 - 120 - 120 - 120 = 720

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Engine data, adjustment values, operating pressures,  
operating temperatures and oil quantities

Typ  
Model  
Type

D 914 / 916

Blatt  
Page  
Feuille

4.2

### Adjustment values:

Begin of delivery in ° KW v. OT	: D 914 T / TI		= 20 ± 1
	D 916 T	n = 1800 / 2100 <sup>1</sup> /min	= 20 ± 1
	D 916 TI	n = 1800 <sup>1</sup> /min	= 20 ± 1
	D 916 T / TI	n = 2000 <sup>1</sup> /min	= 22 ± 1
	D 916 TI	n = 2100 <sup>1</sup> /min	= 15 ± 1
Valve play	: Intake cold	= 0,2 mm	
	Outlet cold	= 0,25 mm	

### Operating pressures:

Compression pressure	: D 914 T / TI	= 19 - 27 bar
	D 916 T / TI	= 19 - 27 bar
Injection pressure	: New	= 225 + 8 bar
	Operating pressure	= 217 + 8 bar
Lube oil pressures with engine at operating temperature	: at nominal RPM	= 3.5 bar
	at 1400 <sup>1</sup> /min	= 2.5 bar
	at 800 <sup>1</sup> /min	= 1.5 bar

Minimum pressure in cooling system with engine at operating temperature: at nominal RPM = 1,1 bar (thermostats open), measured on the coolant pump outlet

### Operating temperatures:

Coolant temperature, maximum	: 100 °C
Thermostats opening temperature	: 71 °C, 79 °C, 83 °C
Lube oil temperature, maximum	: 115 °C

### Oil quantities:

Lube oil in oil pan	: 4 cyl. = max / min	16 / 10 l	} Depending on type of oil pan
	6 cyl. = max / min	20 / 10 l	
		22,5 / 12 l	

Marks on dipstick are the determining factor.

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type	D 914 / 916
Datum / Edition / Date 12 / 2003	Engine data, adjustment values, operating pressures, operating temperatures and oil quantities	Blatt Page Feuille	4.3

## Engine data: D 926 TI

Working procedure	: Four cycle Diesel engine
Combustion procedure	: Direct injection
Bore	: 122 mm
Stroke	: 142 mm
Total volume	: 9.96 dm <sup>3</sup> ( 1,66 dm <sup>3</sup> per cyl.)
Nominal RPM	: 1800, 2000, 2100 <sup>1</sup> /min
Compression ratio	: 16 : 1
Firing order	: 1 - 5- 3 - 6- 2 - 4
Firing distance in ° KW	: 120 - 120 - 120 - 120 - 120 - 120 = 720 °

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type	D 926 TI
	Engine data, adjustment values, operating pressures, operating temperatures and oil quantities	Blatt Page Feuille	4.4
Datum / Edition / Date 12 / 2003			

### Adjustment values:

Begin of delivery in ° KW v. OT	: n = 1800/ 2000 <sup>1</sup> /min	= 20 ± 1°
	n = 2100 <sup>1</sup> /min	= 16 ± 1°
Valve play	: Intake cold	= 0.2 mm
	Exhaust cold	= 0.25 mm

### Operating pressures:

Compression pressure	: 19 - 27 bar	
Injection pressure	: New	= 225 + 8 bar
	Operating pressure	= 217 + 8 bar
Minimum lube oil pressure with engine at operating temperature: at nominal RPM		= 3,5 bar
	at 1400 <sup>1</sup> /min	= 2,5 bar
	at 800 <sup>1</sup> /min	= 1,5 bar

Min. pressure in cooling system with engine at operating temperature: at nominal pressure = 1,1 bar  
Engine (thermostats open) measured on coolant pump exit

### Operating temperatures:

Coolant temperature, maximum	: 100°C
Thermostats opening temperature	: 71°C, 79°C, 83°C
Max. Lube oil temperature	: 115°C

### Oil quantities:

Lube oil in oil pan	: max / min	20 / 10 l	} Depending on type of oil pan
		22.5 / 12 l	
The mark on the dipstick is the deciding factor.			

<b>LIEBHERR</b>	Benennung / Description /	Typ Model Type	D 926 TI
	Engine data, adjustment values, operating pressures, operating temperatures and oil quantities	Blatt Page Feuille	4.5
Datum / Edition / Date 12 / 2003			

**Engine data:        D 924 T-E / TI-E        D 926 T-E / TI-E**

Working procedure        : Four cycle Diesel engine  
Combustion procedure    : Direct injection  
Bore                        : 122 mm  
Stroke                     : 142 mm  
Total volume              : D 924 T-E / TI-E        = 6,64 dm<sup>3</sup>  
                                      D 926T-E / TI-E        = 9,96 dm<sup>3</sup>  
                                      (1,66 dm<sup>3</sup>                per cyl.)  
Nominal RPM              : 1500, 1800, 2000, 2100 <sup>1</sup>/min  
  
Compression ratio        : D 924 T-E / TI-E =     17,2 : 1  
                                      D 926 T-E / TI-E =     17,2 : 1  
  
Firing order               : 4 cyl. = 1 - 3 - 4 - 2  
                                      6 cyl. = 1 - 5 - 3 - 6 - 2 - 4  
  
Firing distance in ° KW   : 4 cyl. = 180 - 180 -180 -180 = 720°  
                                      6 cyl. = 120 - 120 - 120 - 120 -120 - 120 = 720°

<b>LIEBHERR</b>	Benennung / Description / Denomination  Engine data, adjustment values, operating pressures, operating temperatures and oil quantities	Typ Model Type	D 924 T-E / TI-E D 926 T-E / TI-E
		Blatt Page Feuille	4.6
Datum / Edition / Date 12 / 2003			



<b>LIEBHERR</b>	Benennung / Description /	Typ Model Type	D 924 T-E / TI-E D 926 T-E / TI-E
	Datum / Edition / Date 12 / 2003	Engine data, adjustment values, operating pressures, operating temperatures and oil quantities	Blatt Page Feuille 4.7

Description	Torque specifications	For sequence and data, see page
Cylinder head bolts	pretension Nm 30 $\angle^\circ$ 30 + 30 + 60 + 60 = 180 soft cylinder head gasket	7/8
Retighten cylinder head bolts	$\angle^\circ$ 90 soft Cylinder head gasket	7/8
Cylinder head bolts	pretension Nm 30 Nm 90 + $\angle^\circ$ 70 + 70 + 70 + 70 = 280 Metallic elastomer- Cylinder head gasket	7/8
Screws for rocker arm support	M10 x 65 Nm 65 M10 x 110 (ZBS) Nm 75	13
Connecting rod screws	pretension Nm 30 $\angle^\circ$ 45 + 30 + 30 = 105	10
Main bearing screws	pretension Nm 30 $\angle^\circ$ 30 + 30 + 30 = 90	12
Flywheel screws	pretension Nm 30 M14 x 1,5 x 50 $\angle^\circ$ 30 + 35 = 65 Nm 180 - 330 = 330 M16 x 1,5 x 50 $\angle^\circ$ 30 + 25 = 55 Nm 180 - 330 = 330 pretension Nm 90 M16 x 1,5 x 130 $\angle^\circ$ 30 + 30 + 40 = 100 Nm 180 - 330 = 330	29
Timing case screws	pretension Nm 30 M12 x 55 $\angle^\circ$ 30 Nm 80 pretension Nm 45 M12 x 65 $\angle^\circ$ 30 Nm 110 M12 x 140 $\angle^\circ$ 80 Nm 110	
Screws for fan side crankshaft end	pretension Nm 30 M12 x 1,5 x 160 $\angle^\circ$ 45 + 45 = 90 Nm 100 - 160 = 160 M16 x 1,5 x 160 $\angle^\circ$ 40 + 30 + 30 = 100 Nm 100 - 300 = 300	29
Screw on intermediate gear	* pretension Nm 60 $\angle^\circ$ 70 Nm 280	
Screw on camshaft gear	* pretension M 16 x 1,5 Nm 60 $\angle^\circ$ 60 Nm 280 pretension M 20 x 1,5 Nm 130 $\angle^\circ$ 105 Nm 650	
Screw am camshaft gear with gear for fan drive	* pretension M 16 x 1,5 Nm 60 $\angle^\circ$ 60 Nm 280 pretension M 20 x 1,5 Nm 130 $\angle^\circ$ 105 Nm 650	

Description	Torque specifications			For sequence and data, see page
Nut on injection pump drive	pretension	Nm 30	Nm 300	26
Screw for gear injection pump drive (drive mounted in timing case)	pretension	Nm 30 Nm 110	⌘° 40	26.1 / 26.2
Screws for intermediate flange on hub injection pump drive	pretension	Nm 30	Nm 250	26.3
Screws for intermediate flange on gear wheel injection pump drive	pretension	Nm 30	Nm 61	26.3
Nut for gear shaft on injection pump	*** VE-P., H-RP43 M 14 x 1,5   M 18 x 1,5   M 20 x 1,5   M24 x 1,5 Nm 85 <sup>+15</sup> Nm 100 <sup>+10</sup> Nm 150 <sup>+10</sup> Nm 355			25
Injector mount	Nm 23			27
Union nut for fuel injector	D 904/ 906/ 914/ 916/ 926TI   D 924 / 926T-E/TI-E Nm 50 <sup>+20</sup> Nm 40 <sup>+10</sup>			27.1
Injection lines	Nm 20			
Piston cooling nozzle	** Nm 30			10
Screw for coolant pump gear	pretension	Nm 30 Nm 115	⌘° 90	20
Nut on coolant pump impeller	*** Nm 100			20
Screw for coolant pump hub	pretension	Nm 30 Nm 115	⌘° 90	20
Nut for coolant pump impeller (coolant pump integrated in timing case)	* pretension	Nm 30	Nm 70 <sup>+25</sup>	20.1 / 20.2 20.3 / 20.4

**LIEBHERR**

Benennung / Description /

Torque specification

 Typ  
Model  
Type    D 904 / 914 / 924  
                  D 906 / 916 / 926

 Datum / Edition /  
Date  
12 / 2003

 Blatt  
Page  
Feuille    5.1

Description	Torque specifications	For sequence and data, see page
Screw for coolant pump gear (coolant pump integrated in timing case)	* pretension Nm 30    Nm 70 <sup>+25</sup>	20.1 / 20.2 20.3
Screw for coolant pump mounting (coolant pump integrated in timing case)	* Nm 15	20.1 / 20.2 20.3
Screw (lube oil nozzle) for coolant pump mounting, mounted with collar bearing	* Nm 20	20.4, 20.5
Screw for gear fan drive	pretension Nm 30 $\alpha^\circ$ 50 Nm 120	21
Screw for hub on fan drive	pretension Nm 30    M 16 x 1,5 x 80 Nm 270	21.2 / 21.3 / 21.4 / 21.5
Screw for hub on fan drive with fan coupling (2 speed)	pretension Nm 30    M 16 x 1,5 x 140 Nm 270	21.2 / 21.3
Screw for hub on fan drive with Visco and fan coupling (2 speed)	pretension Nm 30    M 16 x 1,5 x 110 Nm 270	21.2 / 21.3 / 21.4
Screw for hub on fan drive with fan coupling (3 speed)	M 16 x 1,5 x 160 Nm 180	21.2 / 21.3
Screw for V-belt on crankshaft	pretension Nm 30 M12 x 45 $\alpha^\circ$ 30 + 15 = 45 Nm 90 - 140 = 140 M12 x 90    Nm 70 - 110 = 110 M16 x 1,5 x 160    Nm 300	29
Screws for Exhaust manifold on cylinder head	M8 x 80    Nm 36	



## Torque specifications

For screws according to DIN 912, 931, 933, 960, 961

Permissible tolerance  $\pm 10\%$

Surface condition: Screw Mn or Zn phosphated, not lubricated or oiled  $\mu$  ges. = 0,14

Regular threads	8,8 Nm	10,9 Nm	12,9 Nm	Fine threads	8,8 Nm	10,9 Nm	12,9 Nm
M6	10	15	18	M8x1	27	39	46
M8	25	36	43	M10x1,25	52	76	90
M10	49	72	84	M12x1,25	93	135	160
M12	85	125	145	M12x1,5	89	130	155
M14	135	200	235	M14x1,5	145	215	255
M16	210	310	365	M16x1,5	225	330	390
M18	300	430	500	M18x1,5	340	485	570
M20	425	610	710	M20x1,5	475	680	790
M22	580	820	960	M22x1,5	630	900	1050
M24	730	1050	1220	M24x2	800	1150	1350

Surface condition: Screws galvanized, not lubricated or oiled  $\mu$  ges. = 0,125

M6	9,6	14	16	M8x1	25	37	43
M8	23	34	40	M10x1,25	49	71	83
M10	46	67	79	M12x1,25	87	130	150
M12	79	115	135	M12x1,5	83	120	145
M14	125	185	220	M14x1,5	135	200	235
M16	195	290	340	M16x1,5	210	310	360
M18	280	400	470	M18x1,5	315	450	530
M20	395	560	660	M20x1,5	440	630	730
M22	540	760	890	M22x1,5	590	840	980
M24	680	970	1150	M24x2	740	1050	1250

**LIEBHERR**

Benennung / Description / Denomination

Typ Model Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Datum / Edition / Date  
12 / 2003

**Torque specification**

Blatt Page Feuille  
5.4

## 6 Valve adjustment

### Valve play: D 904 / 906 / 914 / 916 / 926 TI

Intake cold = 0.20 mm

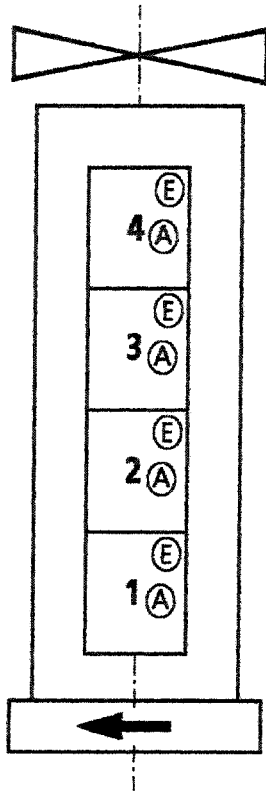
Exhaust cold = 0.25 mm

### D 924 / 926 T-E / TI-E

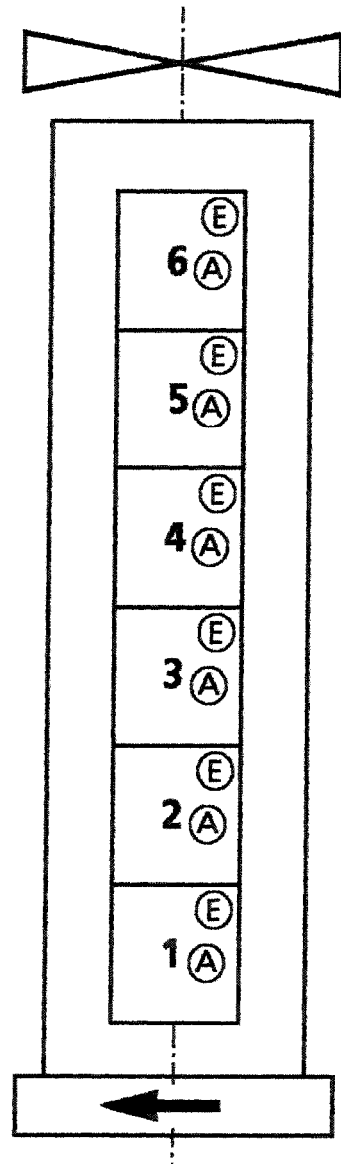
Intake cold = 0.25 mm

Exhaust cold = 0.30 mm

Valves of cylinder			
D 904 / 914 / 924		D 906 / 916 / 926	
overlap	adjust	Overlap	adjust
4	1	6	1
2	3	2	5
1	4	4	3
3	2	1	6
		5	2
		3	4



**E = Inlet valve**  
**A = Outlet valve**



**LIEBHERR**

Datum / Edition / Date  
 12 / 2003

Benennung / Description / Denomination

**Valve adjustment**

Typ  
 Model  
 Type

**D 904 / 914 / 924**  
**D 906 / 916 / 926**

Blatt  
 Page  
 Feuille

**6**



## 6.1 Valve adjustment

### Engine auxiliary brake system (ZBS)

#### Function „ZBS“ for engine brake operation:

If the engine brake flap is closed, pressure waves are building up in the exhaust pipe, which cause the outlet valve to „reopen“. The outlet valve is reopened for a short time every time the flap closes.

Due to the fact that the piston 5 is under pressure, it is „pushed after“ the opening outlet valve, but cannot return, since the adjustment screw 1 closes off the relief bore 6 and the check valve in piston 5 closes off the oil supply bore.

This causes the outlet valve to remain open by about 1.5 to 2 mm during the compression stroke and the subsequent expansion cycle (downward movement of the piston).

#### Check the valve clearance:

**Inlet valve:** Check as without „ZBS“.

**Outlet valve:** Turn the crankshaft until the valves opposite the cylinder, which is to be adjusted overlap (see chart, page 6).

Push the rocker lever with a screwdriver several times onto the valve in the area of piston 5 until no more oil escapes from the relief bore 6.

Insert a feeler gauge between the outlet valve and piston 5 and check the valve clearance.

#### Adjust the valve clearance:

**Inlet valve:** Adjust as without „ZBS“

**Outlet valve:** Loosen the lock nut 2 and turn the adjustment screw 1 out as far as possible without using force.

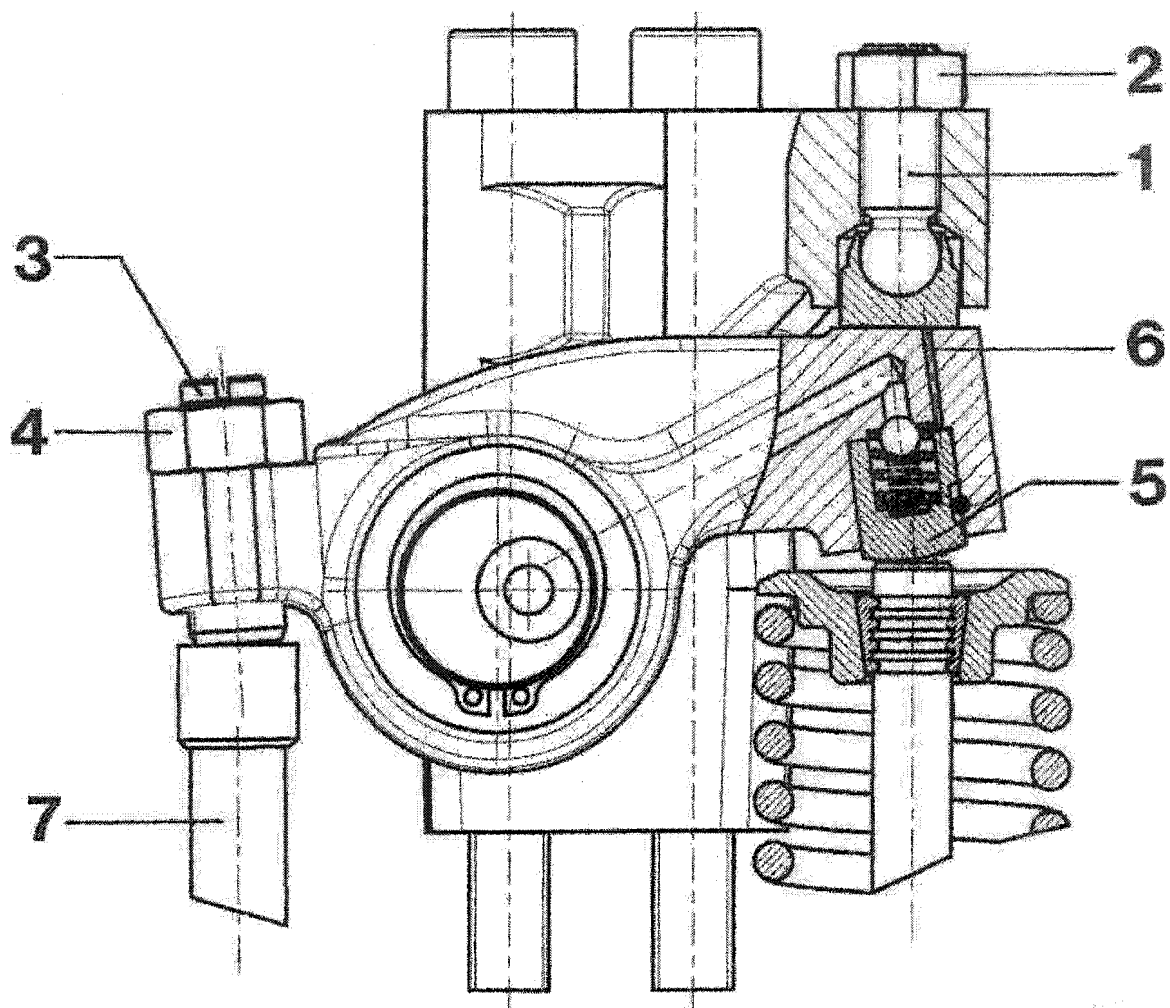
Loosen the lock nut 4 and turn the adjustment screw 3 back until a 0.50 mm feeler gauge can be inserted between piston 5 and the valve.

Turn in the adjustment screw 3 until it clamps on the feeler gauge. The piston 5 is pushed back. Set the valve play of 0.50 mm on adjustment screw 3, tighten the lock nut 4.

Push the feeler gauge 0.30 mm between piston 5 and the valve.

Push the rocker lever with the screw driver in the area of piston 5 onto the valve, until piston 5 stops. Hold piston 5 down and turn in the adjustment screw until the valve clearance is set. Tighten lock nut 2.

After adjustment, check the clearance by turning the plunger rod 7, it must have some play.



- 1 Adjustment screw
- 2 Lock nut
- 3 Adjustment screw
- 4 Lock nut
- 5 Piston
- 6 Relief bore
- 7 Rod

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Valve adjustment "ZBS"

Typ  
Model  
Type

D 924 T/TI-E  
D 926 T/TI-E

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Page  
Feuille

6.1

## **7 Cylinder head gaskets**

On D 904 / 906 / 914 / 916 / 926 TI engines, soft cylinder head gaskets are installed.

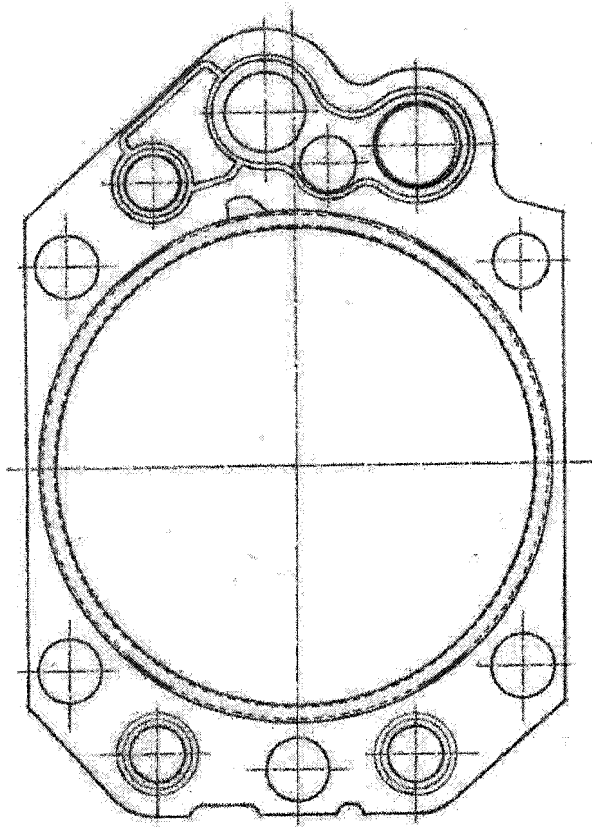
On D 924 / 926 T-E / TI-E engines, the soft cylinder head gaskets have been replaced by metallic elastomer gaskets.

### **Important:**

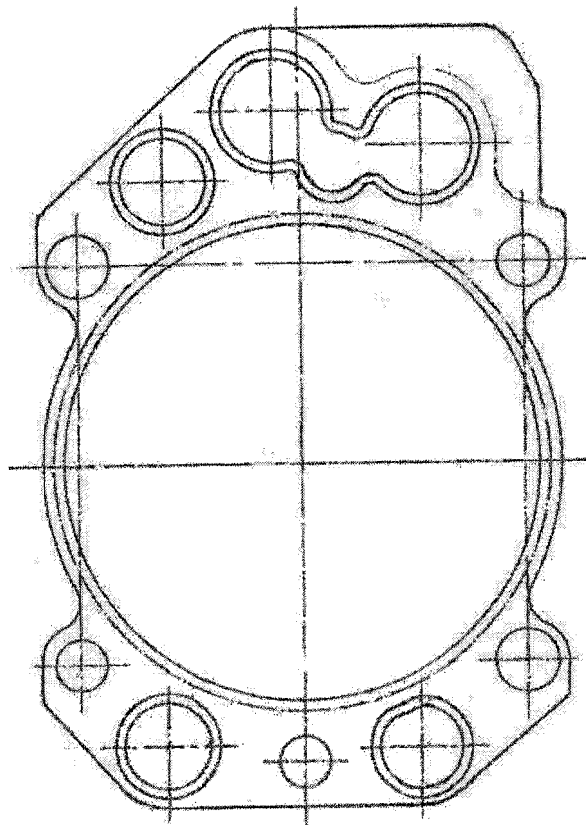
On engines, which were equipped with soft cylinder head gaskets, reinstall soft gaskets.

If metallic elastomer gaskets were installed, also use the same metallic elastomer gaskets due to the different cylinder liner protrusion to the crankcase and the grooves on the seating surface of the gasket.

### Soft cylinder head gasket



### Metallic elastomer cylinder head gasket



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Cylinder head gaskets

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page  
Feuille

7

## 8 Cylinder head

Individual cylinder heads are installed in transverse current principle. The inlet channel is designed as a twist channel.

The connection to the crankcase is made via 6 screws. Valve guides 1 and valve seat rings 2 are inserted in the cylinder head and can therefore be replaced.

Depending on the engine type, one or two valve springs are installed on the outlet valve.

On D 914, 916, 926 TI engines, valve shaft seal rings are installed on some engine types.

On 924 / 926 T-E / TI-E engines, the installation of valve shaft seal rings is standard.

### Valve seat angle:

#### D 904 / 906 NA

Inlet valve = 45°  
Outlet valve = 45°

#### D 904 / 906 TB, 904 T, 906 T/TI, 914 T/TI, 916 T/TI D 926 TI, 924 T-E / TI-E, 926 T-E / TI-E

Inlet valve = 30°  
Outlet valve = 45°

### Valve spring:

		D 904 / 906	D 914 / 916/ 926 TI
Outer spring:	Length not tensioned, normal	= 57 mm	= 57 mm
	Length not tensioned fatigue limit	= 55 mm	= 55 mm
Inner spring	Length not tensioned normal		= 49.8 mm
	Length not tensioned fatigue limit		= 47 mm
<b>D 924 / 926 T-E / TI-E</b>			
Outer spring:	Length not tensioned normal	= 63.5 mm	
	Length not tensioned fatigue limit	= 61.5 mm	
Inner spring	Length not tensioned normal	= 55.5 mm	
	Length not tensioned fatigue limit	= 53.5 mm	

**Allen head screws:** Length normal = 161.5 mm  
Length limit value = 162.5 mm

### Tightening torque specification for soft cylinder head gaskets:

Pretension Nm 30  $\angle^{\circ}$  30 + 30 + 60 + 60 = 180

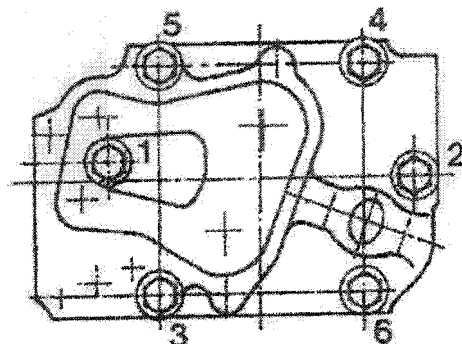
After installation, run the engine until warm, let it cool off and re-tighten when cold.

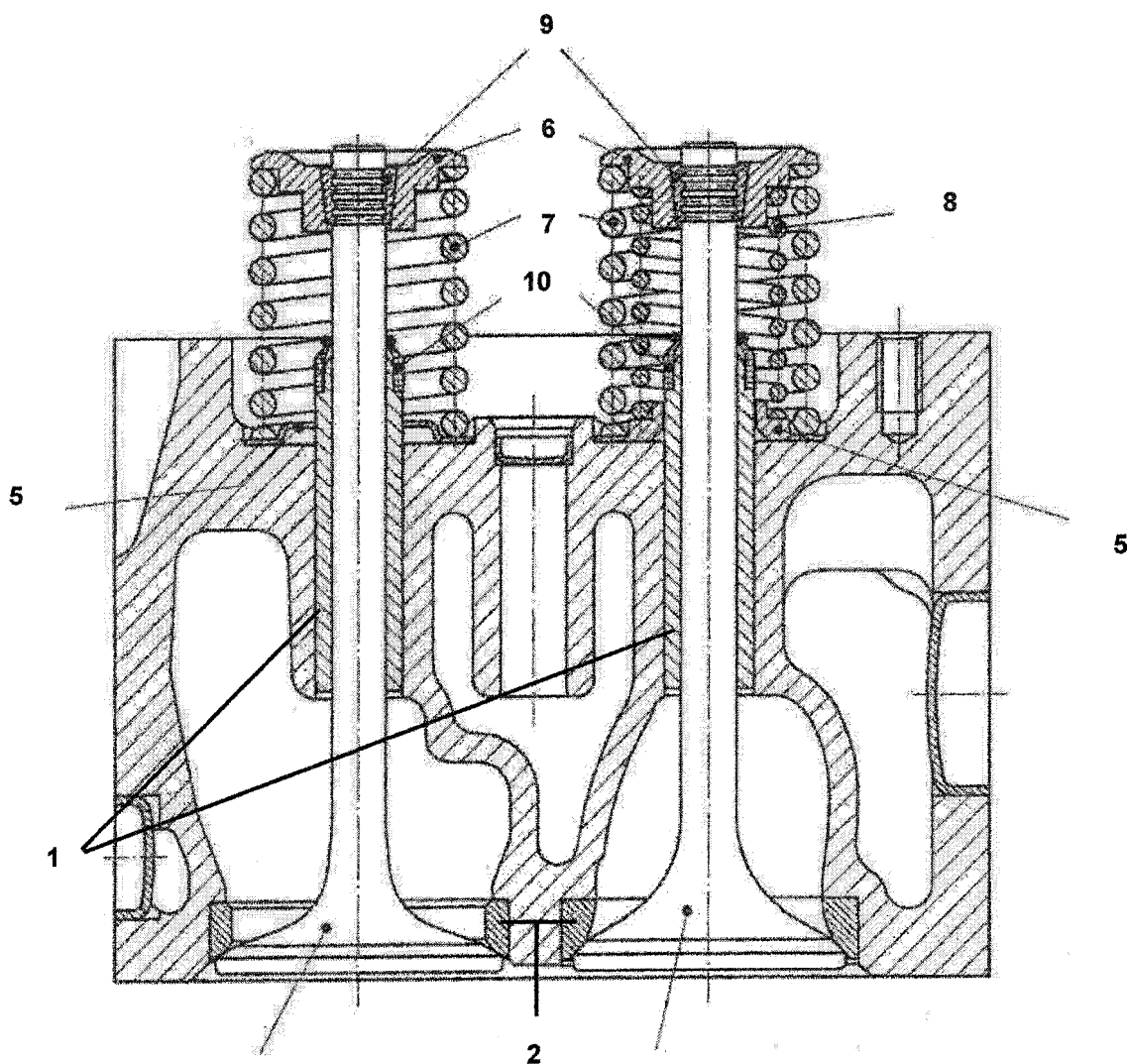
Re-tightening value :  $\angle^{\circ}$  90

### Tightening torque specification for metallic elastomer cylinder head gaskets:

Pretension Nm 30 Nm 90 +  $\angle^{\circ}$  70 + 70 + 70 + 70 = 280

### Sequence:





- 1 Valve guides
- 2 Valve seat rings
- 3 Inlet valve
- 4 Outlet valve
- 5 Spring plate, bottom
- 6 Spring plate, top
- 7 Valve springs, outside
- 8 Valve spring, inside
- 9 Valve stem
- 10 Valve shaft seal rings

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Cylinder head

Typ Model D 904 / 914 / 924  
Type D 906 / 916 / 926

Blatt Page 8  
Feuille

## 9 Cylinder liner

The cylinder liner 1 is a wet liner.

It is sealed to the crankcase on the collar side with an O-ring 2.

The O-ring 2 on the collar side drops out for engines D 914 / 916 / 924 / 926 beginning with serial number 2003 01 2970

Three O-rings 3 are used to seal the fluid chamber down to the crankcase.

The modification from 2 to 3 O-rings was for D 924 / 926-E engines beginning from ca. 03 / 2001

**Removal:** Remove the cylinder head and the oil pan, remove the piston with the connecting rod. Pull the cylinder liner with the pulling device.

**Note:** In case the cylinder liner is being reused, mark the liner and the crankcase.

**Installation:** Clean the liner flange, the bore and seating surfaces for the O-rings. Lightly grease O-rings with GBUY 131 and push the cylinder liner in the crankcase.

### Cylinder liner protrusion to crankcase:

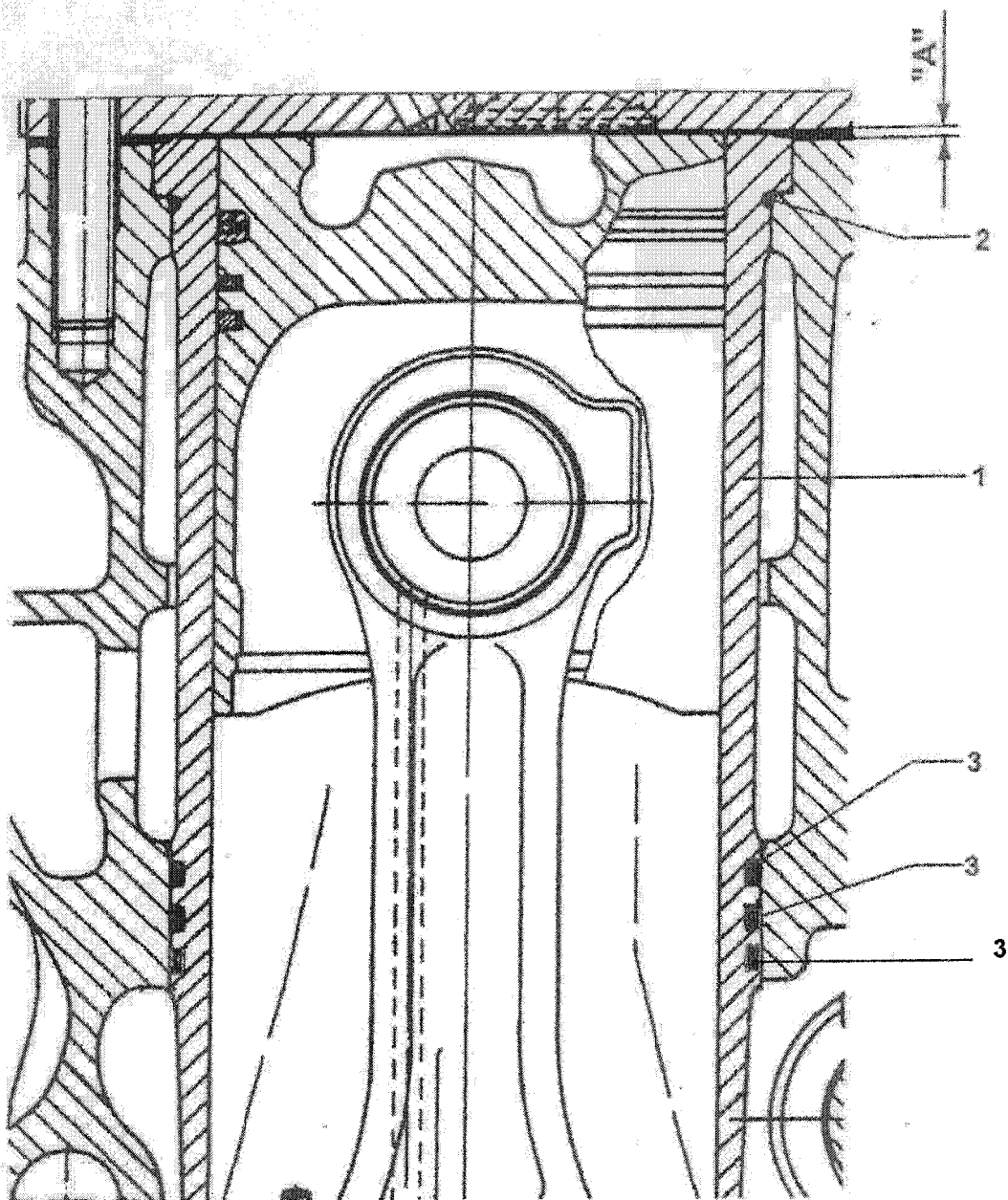
The liner protrusion „A“ to the crankcase with installation of soft cylinder gasket is +0.03 to +0.08 mm.

For installation of metallic elastomer cylinder head gasket, the protrusion is + 0,05 to + 0,1 mm.

### Note:

If the cylinder liner protrusion „A“ to the crankcase is not sufficient, then it is possible to re-machine the crankcase collar and use a repair cylinder liner with a higher collar to obtain the correct liner protrusion „A“.

When re-machining, try to obtain the upper limit of the cylinder liner protrusion „A“ .



- 1 Cylinder liner
- 2 O-ring (collar side)
- 3 O-ring (bottom)

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Cylinder liner

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page 9  
Feuille



## 10 Piston and connecting rod

### Piston:

All engine models use the 3-ring piston 1 with cast ring carrier 2 for the upper seal ring.

The difference between the pistons is a different combustion cavity 3, shape and diameter for individual engine models.

<b>Piston rings:</b>	Different diameters:	D 904 / 906 Ø Piston 115 mm
		D 914 / 916 Ø Piston 120 mm
		D 924 / 926 Ø Piston 122 mm

NA / TB - engines:

Ring 4	=	Dual trapezoid ring, chrome-plated and convex
Ring 5	=	Minute ring, all sides iron oxidized
Ring 6	=	Hose spring ring chrome-plated (oil scraper ring)

Ring 4= Dual trapezoid ring covered with Molybdan, convex  
Ring 5 + 6 same as NA / TB engines.

T / T1 - engines:

### Note:

When installing the piston rings, the top mark must point to the piston bottom.

### Piston pin:

The pin 7 (Ø 45 mm) is pressure lubricated via the bored connecting rod 8.  
It is floating in the piston and attached with retaining rings.

### Piston cooling nozzle:

All engine models are equipped with piston cooling nozzles 9.  
Opening pressure: 0.8 - 1 bar, Tightening torque = Nm 30, retaining fluid Loctite 262 or Omnifit 100M.

## **Piston and connecting rod removal and installation:**

### **Removal:**

Remove the cylinder head and the oil pan. Loosen and remove the mounting bolts 10.  
Remove the bearing cap 11 with bearing shell.  
Push the piston 1 with connecting rod 8 through the cylinder liner.

### **Note:**

If the pistons or liners are reused, reinstall them as a pair. Do not mix up the connecting rod bearing shells.

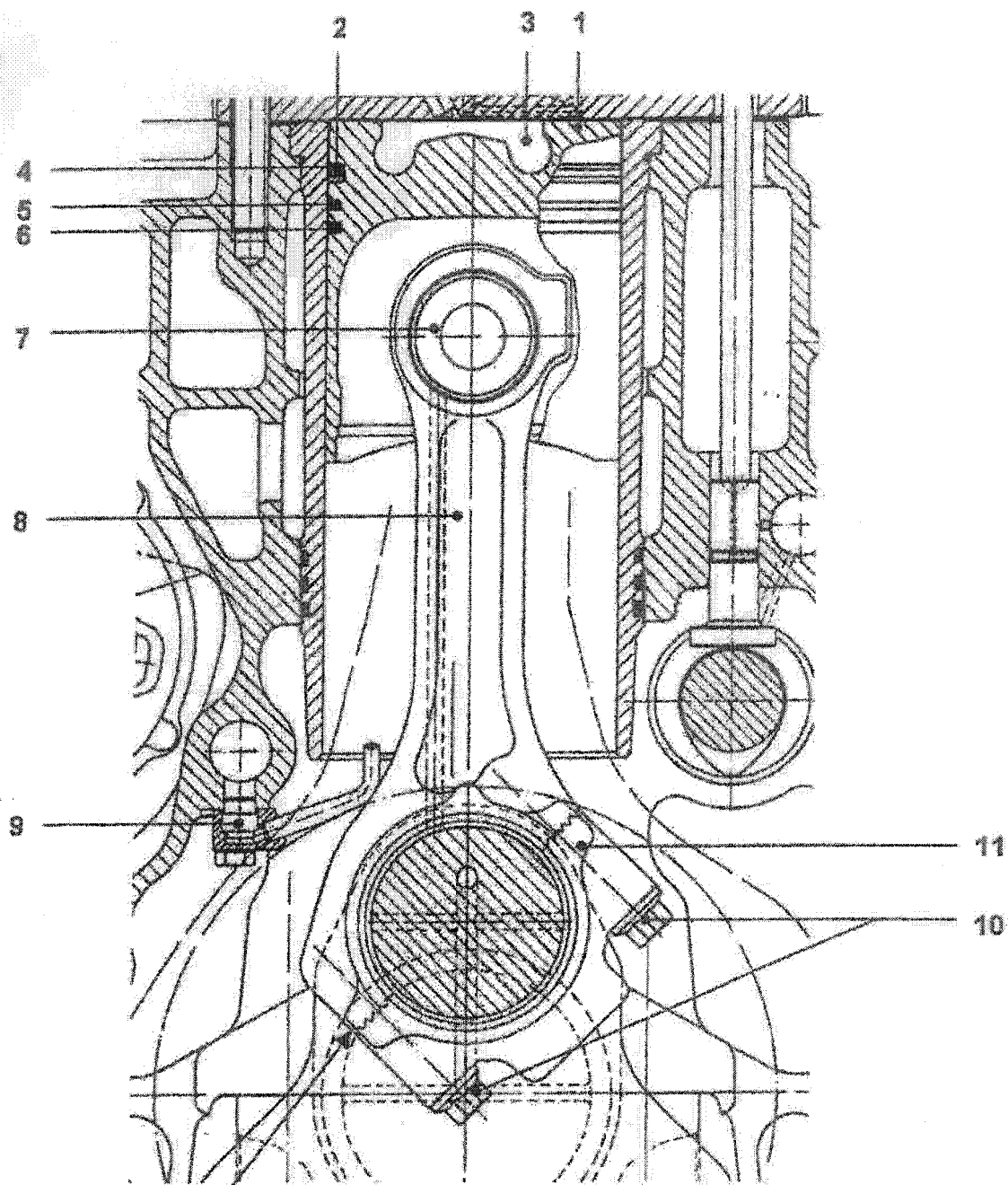
### **Installation:**

When installing the piston on the connecting rod 8, position the recess for the piston cooling nozzle 9 on piston 1 at the marked connecting rod side.  
The marked connecting rod side must be positioned at the right side, as seen from the flywheel (engine in normal position).  
Position the piston rings on rods to each other and tighten with piston ring compressor. Insert the bearing into the connecting rod 8 and push the connecting rod 8 and piston 1 into the cylinder liner until the bearing shell touches the pin. Install the bearing cap 11 with bearing shell. The marks to the connecting rod must match. Install the mounting screws 10 and tighten according to tightening torque.

**Mounting bolts:**                      Length normal        = 65 – 0.6 mm  
   Length limit value    = 65.5 mm

**Tightening torque connecting rod:**    Pretorque Nm  $30 \times 45 + 30 + 30 = 105$

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Piston and connecting rod	Blatt Page Feuille	10



Connecting rod description

- |                      |                         |
|----------------------|-------------------------|
| 1 Piston             | 9 Piston cooling nozzle |
| 2 Ring carrier       | 10 Connecting rod bolts |
| 3 Combustion chamber | 11 Bearing cap          |
| 4 Double Acme ring   |                         |
| 5 Minute ring        |                         |
| 6 Oil scraper ring   |                         |
| 7 Piston bolt        |                         |
| 8 Connecting rod     |                         |

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Piston and connecting rod

Typ	D 904 / 914 / 924
Model	D 906 / 916 / 926
Type	

Blatt  
Page  
Feuille

10

## 11 Check piston clearance

The gap between the piston and the cylinder head is 1.15 to 1.67 mm.

When changing piston, connecting rod, crankshaft or crankcase, the piston clearance (gap) can be measured.

### Check:

Place a test bridge with two test dial gauges crosswise of the engine onto the crankcase. Measure the highest point of the piston to the crankcase. Determine the medium value (dimension A) of two measured values and compare it with the data given in the chart.

### Note:

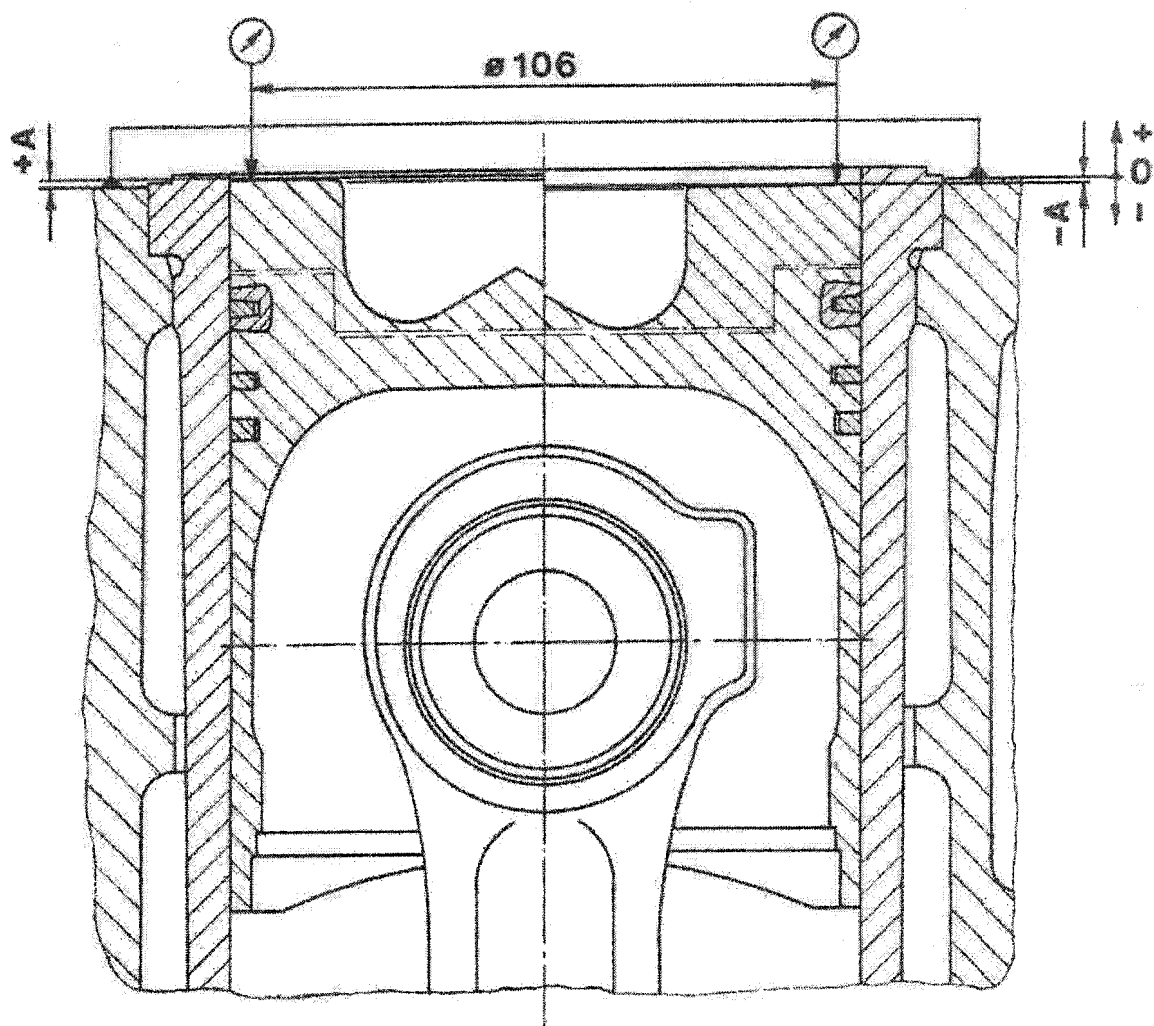
On the test dial gauge holder, note the various test points for the test dial gauges, in relation to the piston diameters.

D 904 / 906	= Ø Piston 115 mm	= Ø Test point 106 mm
D 914 / 916	= Ø Piston 120 mm	= Ø Test point 115 mm
D 924 / 926	= Ø Piston 122 mm	= Ø Test point 115 mm

The values given in the chart are only valid for these test points.

Chart - control dimension - piston clearance

Dimension A (mm) Medium value of two test points	Cylinder head gasket „thickness“	Cylinder head gasket
-0,24 bis + 0,09	1.3 mm	Soft gasket
	1.25 mm	Metalic lelastomer gasket



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

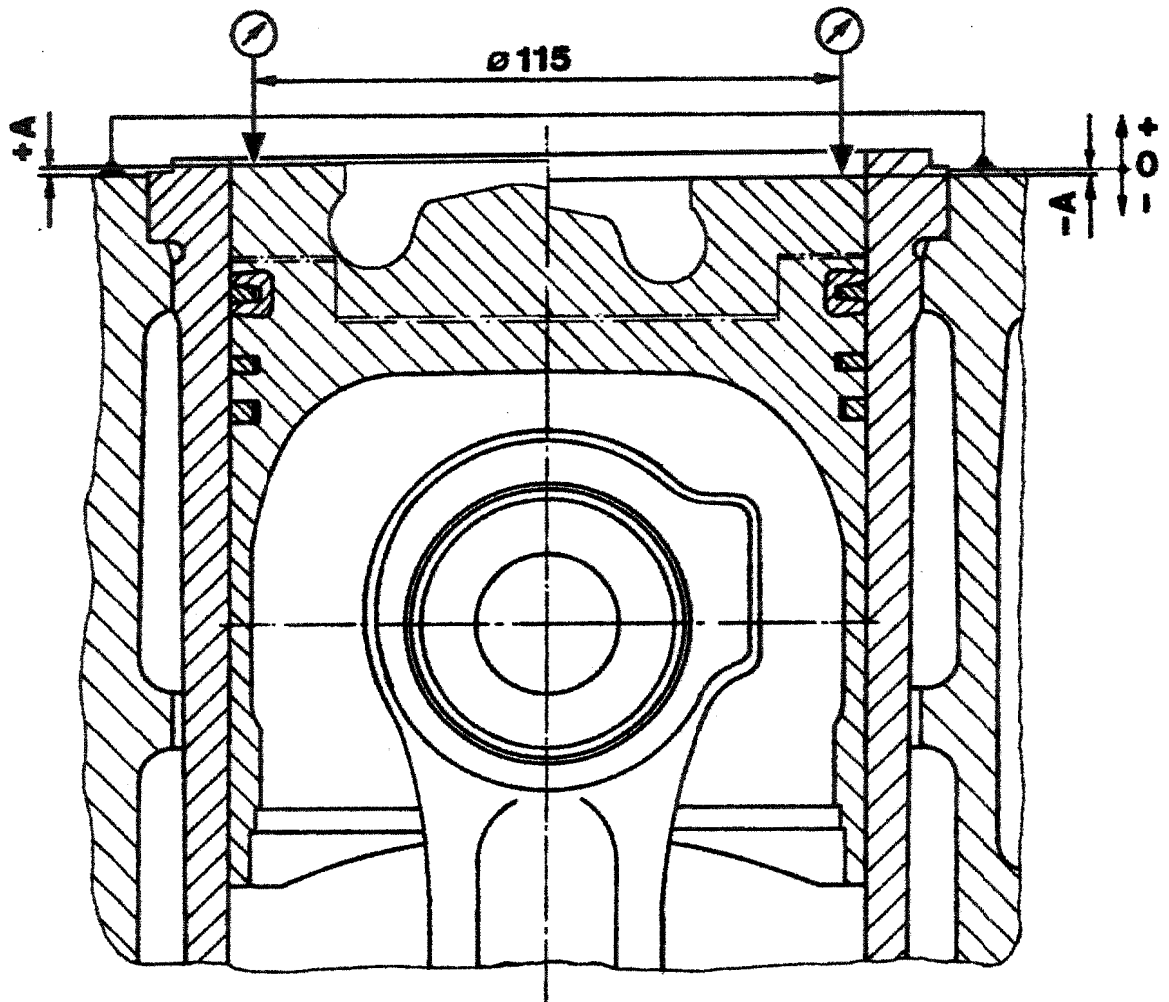
Check piston clearance

Typ  
Model  
Type

D 904 / 906

Blatt  
Page  
Feuille

11



Blatt 11-1-1

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Check piston clearance

Typ  
Model  
Type

D 904 / 906

Blatt  
Page  
Feuille

11.1

## 12 Crankshaft and bearing

On 4 cylinder engines, the crankshaft 1 is placed in five bearings, on 6 cylinder engines in seven.

Two counterweights 3 are welded onto each connecting rod bearing 2.

A mated bearing 4 with four thrust washers 5 is installed in the bearing base.

The fixation points in the thrust washers 5 or in the recesses in the bearing base are designed in such a way, that the thrust washers 5 cannot be installed the wrong way.

The lubrication pockets in the thrust washers 5 face the crankshaft walls when installed.

The main bearing pins 6 have a diameter of 98 mm, the connecting rod pins 2 have a diameter of 75 mm.

To prevent rotation vibrations, a vibration damper is installed on the fan side. D 904 NA / TB engines do not require a vibration damper.

### **Bearing base - Numbering system:**

From the flywheel side on, the main bearing caps are numbered with running numbers, 1, 2, 3, etc. In the crankcase, starting from the flywheel side, the bearing cap are numbered in sequence.

The crankcase numbers are engraved in the crankcase on the underside of the crankcase, opposite the fanside bearing base into the crankcase.

All main bearing caps are numbered with the crankcase number.

The numbers are on the left side, as seen from the flywheel side onto the engine.

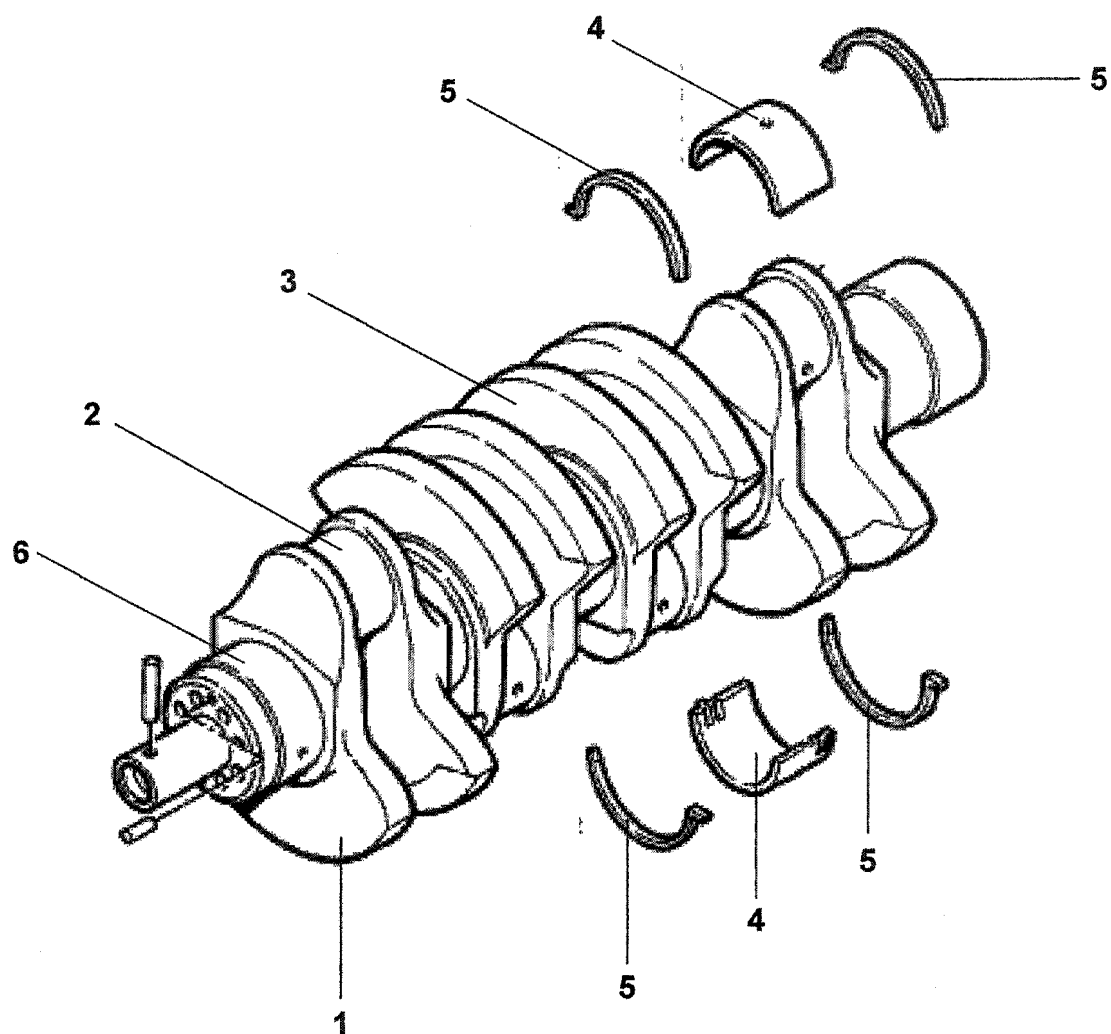
Crankcase position: Oil pan side points upward.

### **Note:**

Main bearing cap numbers and crankcase numbers must match for installation.

### **Tightening torque - main bearing:**

Pre-torque Nm  $30 \pm 30 + 30 + 30 = 90$



- 1 Crankshaft
- 2 Bearing pins
- 3 Counterweight
- 4 Bearing
- 5 Thrust washer
- 6 Main bearing pin

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Crankshaft and bearing

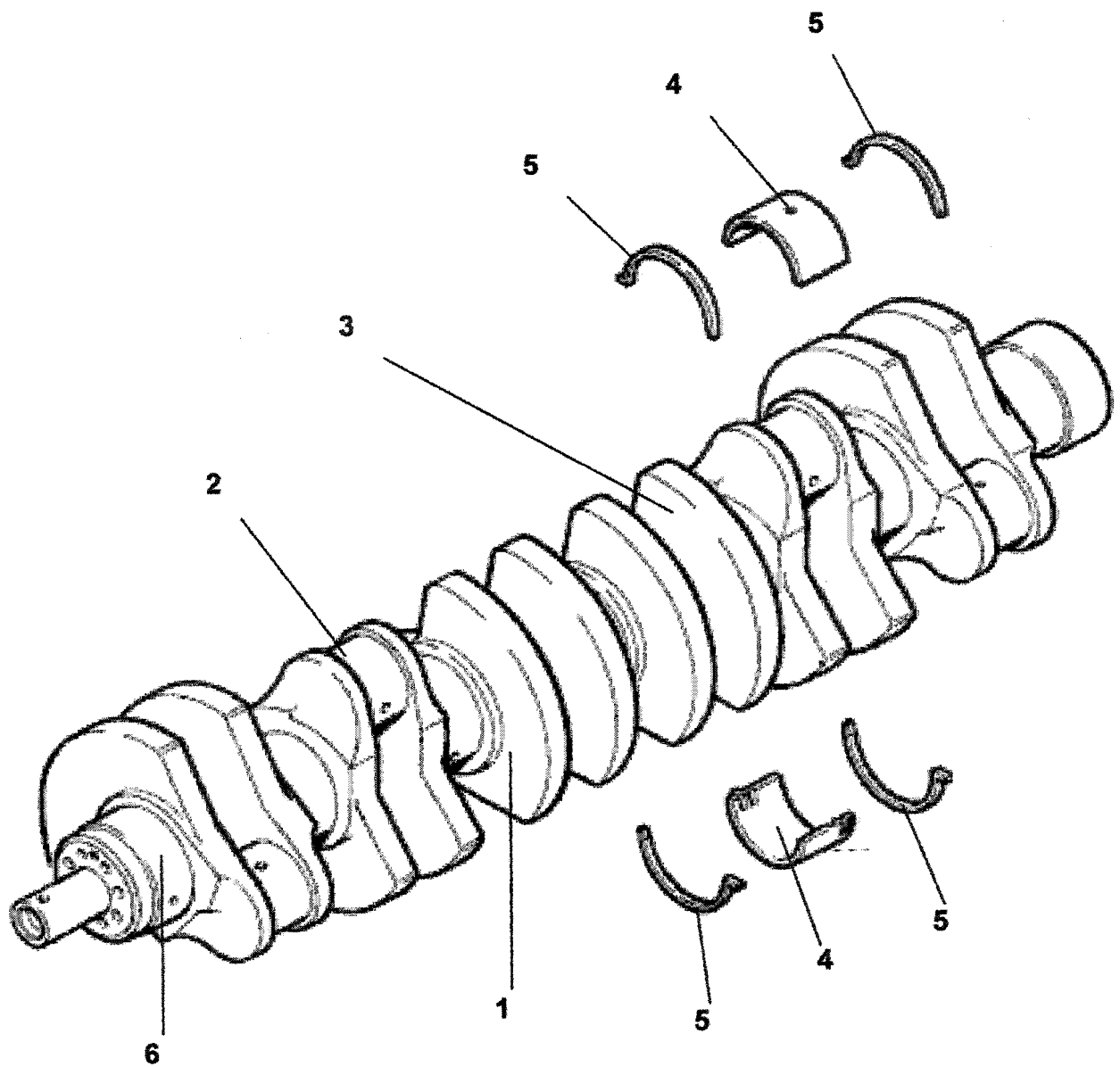
Typ  
Model  
Type

D 904 / 914 / 924

Blatt  
Page  
Feuille

12





- 1 Crankshaft
- 2 Bearing pins
- 3 Counterweight
- 4 Bearing
- 5 Thrust washer
- 6 Main bearing pin

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Crankshaft and bearing	Blatt Page Feuille 12.1

## 13 Camshaft and valve drive

The camshaft 1 is made of tempered steel.  
Cam and running surfaces of the bearing pins are hardened.

The valves are actuated via plungers 2.  
Steel plungers 3 and rocker arms 4.

The parts are the same for inlet and outlet valves.  
To improve the gliding ability between ca. and valve plunger, was on D 924 / 926-E engines beginning from ca. 03 / 2001 a cam lubrication introduced.

The region of cam and valve plunger is lubricated by spray nozzles mounted in the crankcase in the area of the valve plunger bores,

### Camshaft - set in crankcase:

4 cylinder engine = 5 times

6 cylinder engine = 7 times

Cam stroke inlet = 8,5 mm

Cam stroke outlet = 9 mm

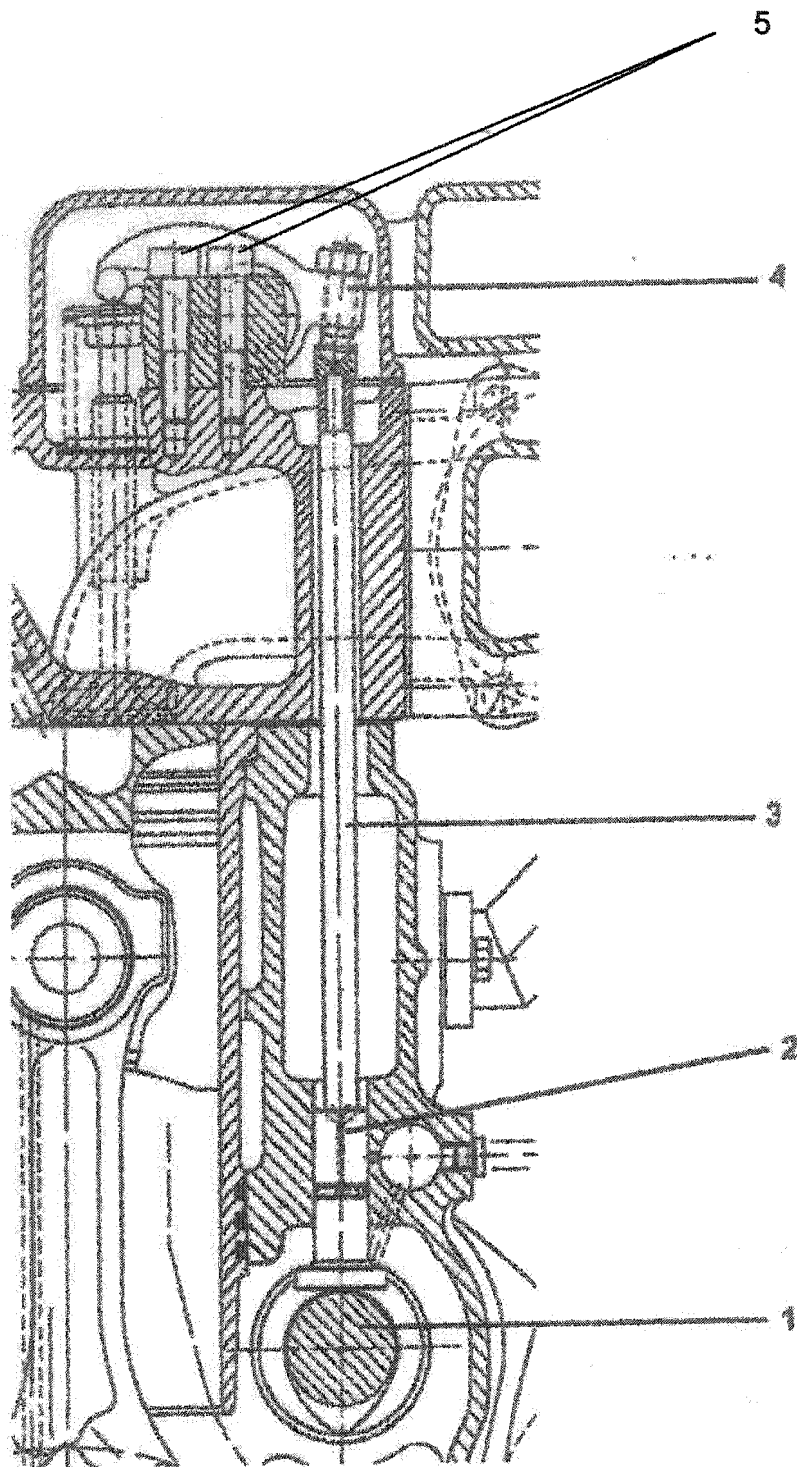
<b>Control times:</b>	Inlet opens	15° KW v. OT
	Outlet closes	45° KW n. UT
	Outlet opens	54° KW v. UT
	Outlet closes	14° KW n. OT

KW = Kurbelwinkel = Crank angle, OT = Oberer Totpunkt = upper TC,

UT = Unterer Totpunkt = lower TC.

### Tightening torque for screws 5:

M10 x 65	M10 x 110 (zBs)
Nm 65	Nm 75



- 1 Camshaft
- 2 Tappet
- 3 Steel push rods
- 4 Rocker lever
- 5 Screws

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Camshaft and valve drive

Typ Model Type  
D 904 / 914 / 924  
D 906 / 916 / 926

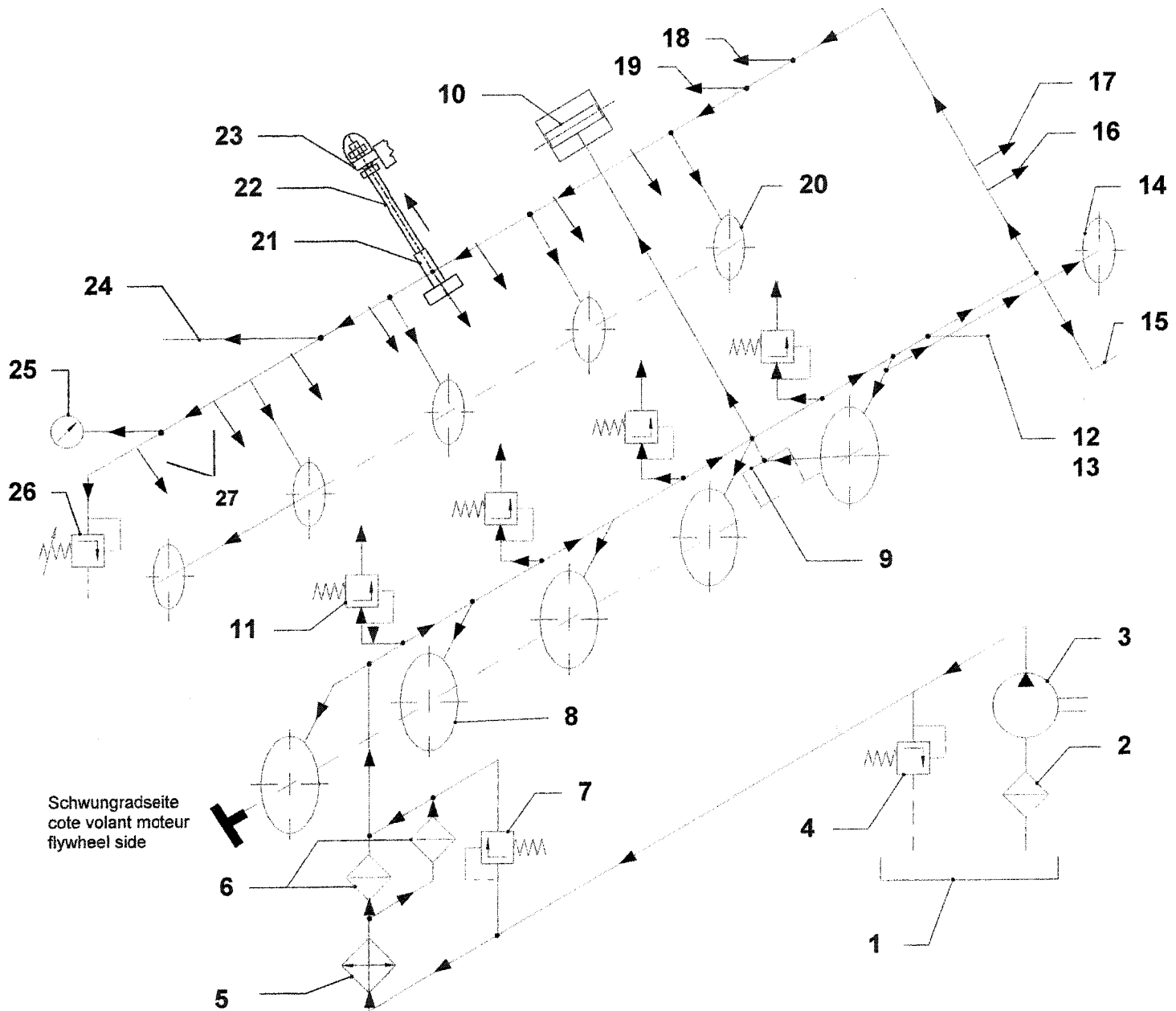
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Page  
Feuille

13

## **14 Lube oil circuit**

Schematic view on D 904, 914, 924 engines.

- 1 Oil pan**
- 2 Suction funnel**
- 3 Lube oil pressure pump**
- 4 Relief valve (opening pressure  $9 \pm 1$  bar)**
- 5 Oil cooler**
- 6 Oil filter**
- 7 Bypass valve (opening pressure  $6 \pm 1$  bar)**
- 8 Main bearing - crankshaft**
- 9 Connecting rod bearing**
- 10 Piston pin**
- 11 Piston cooling nozzle (opening pressure 0.8 - 1 bar)**
- 12 Connection for injection pump**
- 13 Connection for hydraulic pumps - auxiliary drive**
- 14 Intermediate gear**
- 15 Drive for injection pump**
- 16 Fan drive**
- 17 Lubrication nozzle for gears**
- 18 Connection for air compressor**
- 19 Connection for cooling pump**
- 20 Bearing - camshaft**
- 21 Valve plungers**
- 22 Push rod**
- 23 Rocker lever**
- 24 Connection for turbo charger**
- 25 Oil pressure transmitter**
- 26 End regulating valve**
- 27 Cam lubrication**



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Lubrication circuit

Typ  
Model  
Type

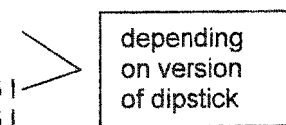
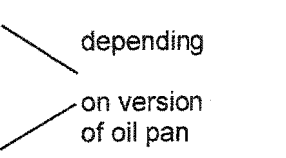
D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille

14

## 15 Oil pans

### Lube oil in oil pan:

D 904 / 914 / 924	max	= 16 l	
	min	= 10 l	
	max	= 20,5 l	
	min	= 13,5 l	
D 906 / 916 / 926	max	= 20 l	
	min	= 10 l	
	max	= 22 l	
	min	= 12 l	

### Permissible incline position to all sides: Oil pans with oil sump

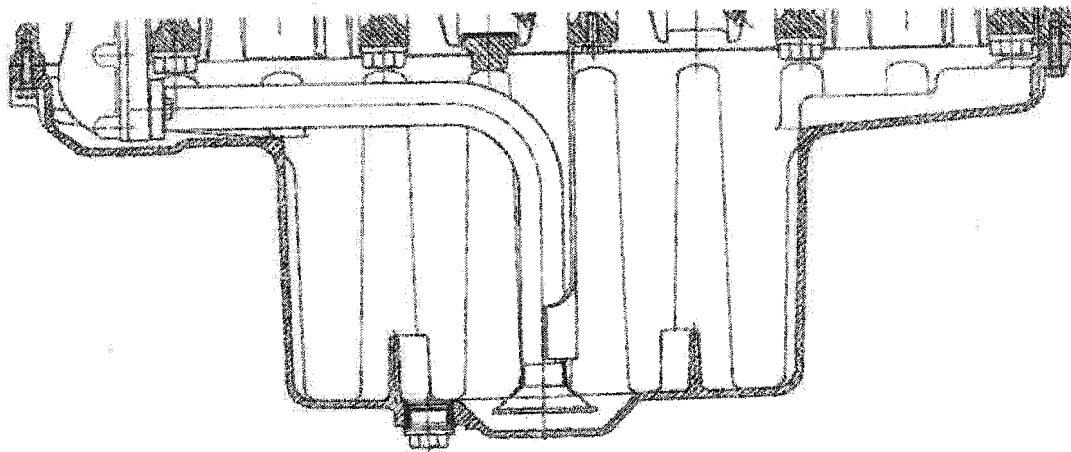
D 904 / 914 / 924 = 45° (100%)

D 906 / 916 / 926 = 45° (100%)

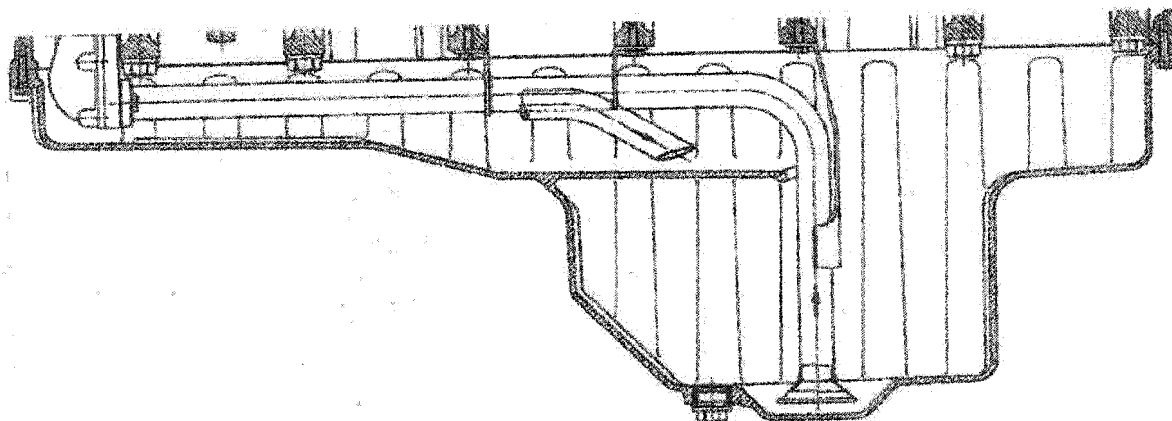
### Oil pans without oil sump

D 904 / 914 / 924 = 3° (7%)

D 906 / 916 / 926 = 3° (7%)



**4 cylinder oil pan**



**6 cylinder oil pan**

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Oil pans

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page 15  
Feuille

## 16 Lube oil pumps

D 904 / 914	: Pressure pump	
RPM	: Engine n <sup>1</sup> /min	= 1800 / 2000 / 2100
	Pressure pump n <sup>1</sup> /min	= 2520 / 2800 / 2940
Supply gear width	: 15 / 18 mm	

D 924	: Pressure pump	
RPM	: Engine n <sup>1</sup> /min	= 1500 / 1800 / 2000 / 2100
	Pressure pump n <sup>1</sup> /min	= 2100 / 2520 / 2800 / 2940
Supply gear width	: 18 / 20 mm	

D 906 / 916 / 926 TI	: Pressure pump + suction pump	
RPM	: Engine n <sup>1</sup> /min	= 1800 / 2000 / 2100
	Pressure pump n <sup>1</sup> /min	= 2520 / 2800 / 2940
	Suction pump n <sup>1</sup> /min	= 2520 / 2800 / 2940
Supply gear width	: Pressure pump	= 23 / 27 mm
	Suction pump	= 27 / 30 mm

D 926 TI-E	: Pressure pump + suction pump	
RPM	: Engine n <sup>1</sup> /min	= 1500 / 1800 / 2000 / 2100
	Pressure pump n <sup>1</sup> /min	= 2100 / 2520 / 2800 / 2940
	Suction pump n <sup>1</sup> /min	= 2100 / 2520 / 2800 / 2940
Supply gear width	: Pressure pump	= 27 / 30 mm
	Suction pump	= 30 / 33 mm

**Supply power:** Supply gear width 15 mm = 59 l / min / 2520<sup>1</sup>/min

**Pressure pump** 66 l / min / 2800<sup>1</sup>/min  
69 l / min / 2940<sup>1</sup>/min

Supply gear width 18 mm =	Supply gear width 20 mm =	Supply gear width 23 mm =
59 l / min / 2100 <sup>1</sup> /min	65 l / min / 2100 <sup>1</sup> /min	91 l / min / 2520 <sup>1</sup> /min
71 l / min / 2520 <sup>1</sup> /min	78 l / min / 2520 <sup>1</sup> /min	101 l / min / 2800 <sup>1</sup> /min
79 l / min / 2800 <sup>1</sup> /min	87 l / min / 2800 <sup>1</sup> /min	106 l / min / 2940 <sup>1</sup> /min
83 l / min / 2940 <sup>1</sup> /min	91 l / min / 2940 <sup>1</sup> /min	

Supply gear width 27 mm =	Supply gear width 30 mm =
89 l / min / 2100 <sup>1</sup> /min	98 l / min / 2100 <sup>1</sup> /min
106 l / min / 2520 <sup>1</sup> /min	118 l / min / 2520 <sup>1</sup> /min
118 l / min / 2800 <sup>1</sup> /min	131 l / min / 2800 <sup>1</sup> /min
124 l / min / 2940 <sup>1</sup> /min	138 l / min / 2940 <sup>1</sup> /min

### Supply power / suction pump:

Supply gear width 27 mm =	Supply gear width 30 mm =	Supply gear width 33 mm =
106 l / min / 2520 <sup>1</sup> /min	98 l / min / 2100 <sup>1</sup> /min	108 l / min / 2100 <sup>1</sup> /min
118 l / min / 2800 <sup>1</sup> /min	118 l / min / 2520 <sup>1</sup> /min	130 l / min / 2520 <sup>1</sup> /min
124 l / min / 2940 <sup>1</sup> /min	131 l / min / 2800 <sup>1</sup> /min	144 l / min / 2800 <sup>1</sup> /min
	138 l / min / 2940 <sup>1</sup> /min	151 l / min / 2940 <sup>1</sup> /min

### Note:

No suction pump is installed on 6 cylinder engines with oil pans without oil sump (incline 3°) .



**Axial play of feed gears**      normal      : 0.05 – 0.12 mm  
   limit value      0.22 mm

**Backlash of oil pump gears 8,9 to drive gear 1 on crankshaft:** 0.15 – 0.25 mm

**Engine position:** oil pan side points upward.

**Relief valve 2 relief pressure:**  $9 \pm 1$  bar.

#### **Lube oil pressure pump removal:**

Remove the oil pan and the timing case. Remove the oil suction line from the pressure pump  
4. Remove screws 3 and remove the pressure pump 4 from the crankcase.

#### **Note:**

If suction pump 5 is installed, the lube oil line 6 must also be removed.

#### **Suction pump removal:**

Remove the oil pan and timing case. Remove the suction line from the suction pump 5.  
Remove the lube oil line 6. Remove screws 7 and remove the suction pump 5 from the crankcase.

#### **Lube oil pressure pump installation:**

Install the pressure pump 5 on the crankcase. Tighten screws 3 lightly. Set the backlash between gear 8 and gear 1 on the crankshaft by moving the pressure pump 4, using a feeler gauge. Tighten screws 3. Install the suction line with seal. Install the timing case and the oil pan.

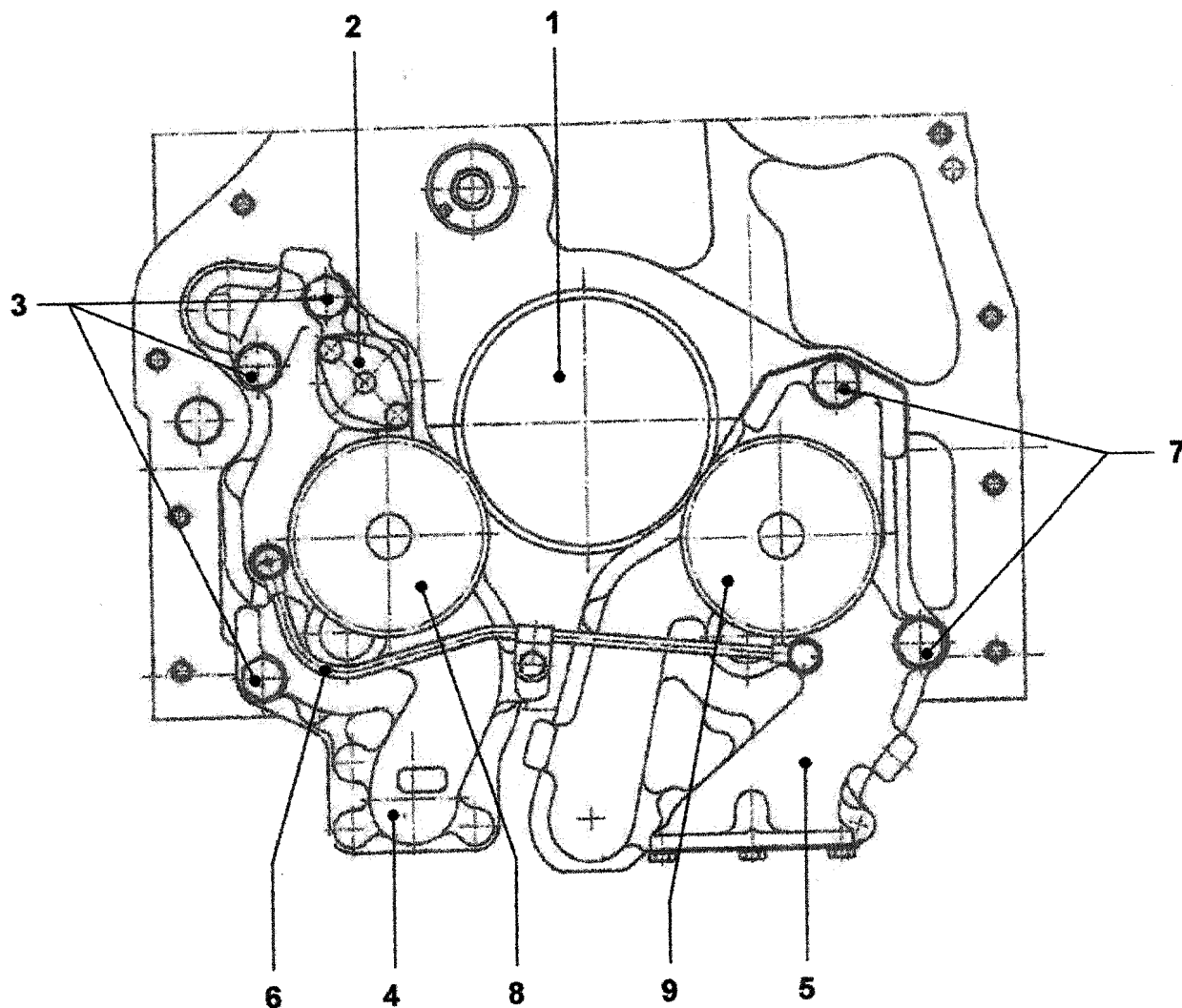
#### **Note:**

If suction pump 5 is installed, the lube oil line 6 must also be installed.

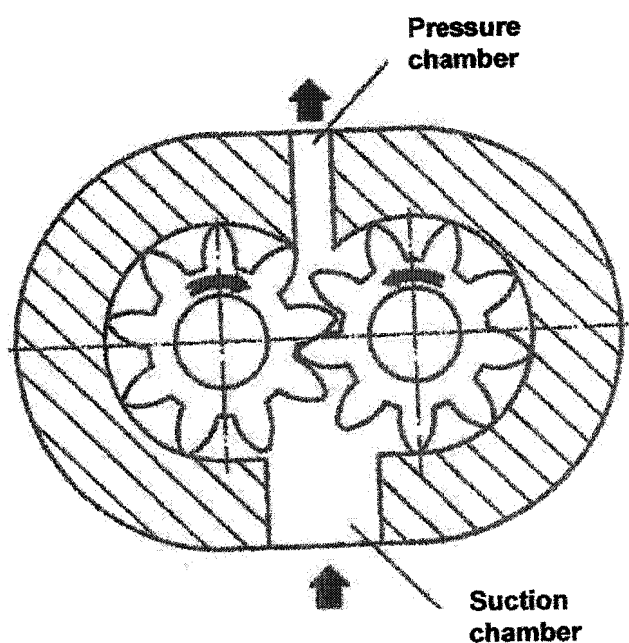
#### **Suction pump installation:**

Install the suction pump 5 on the crankcase. Tighten screws 7 lightly. Set the backlash between the gear 9 and gear 1 on the crankcase by moving the suction pump 5, using a feeler gauge. Tighten screws 7. Install the suction lines with seals. Install lube oil line 6. Install timing case and oil pan.

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Lube oil pump	Blatt Page Feuille	16



- 1 Drive gear
- 2 Relief valve
- 3 Mounting screws
- 4 Pressure pump
- 5 Suction pump
- 6 Lube oil line
- 7 Mounting screws
- 8 Gear pressure pump
- 9 Gear suction pump



**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Lube oil pumps

Typ Model Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille

16

## 17 Lube oil filter and oil cooler

The oil cooler is installed on the oil cooler housing, on the right hand side of the crankcase, when viewed onto the flywheel right.

The lube oil filter can be installed „hanging“ or „upright“ on the oil cooler housing or away from the oil cooler housing, depending on the engine model.

When it is installed away from the oil cooler housing, the connections must be connected as shown on page 17.1.

### **Removal:**

Drain the coolant on plug 5. Remove the lube oil filter 4 from the oil filter console 3. If the lube oil filter is installed away from the oil cooler housing, remove the oil lines from the oil cooler housing 2. Remove the connector screws from the oil cooler housing 2 to the crankcase. Remove the oil cooler housing 2 together with the oil filter console 3 and the oil cooler 1 from the crankcase.

### **Note:**

To remove the oil cooler housing 2, only the two outer screws on the oil filter console 3 need to be removed (see arrows).

### **Important:**

When removing the oil cooler housing 2, make sure that the bypass valve between the oil cooler housing 2 and the crankcase is also removed.

### **Installation:**

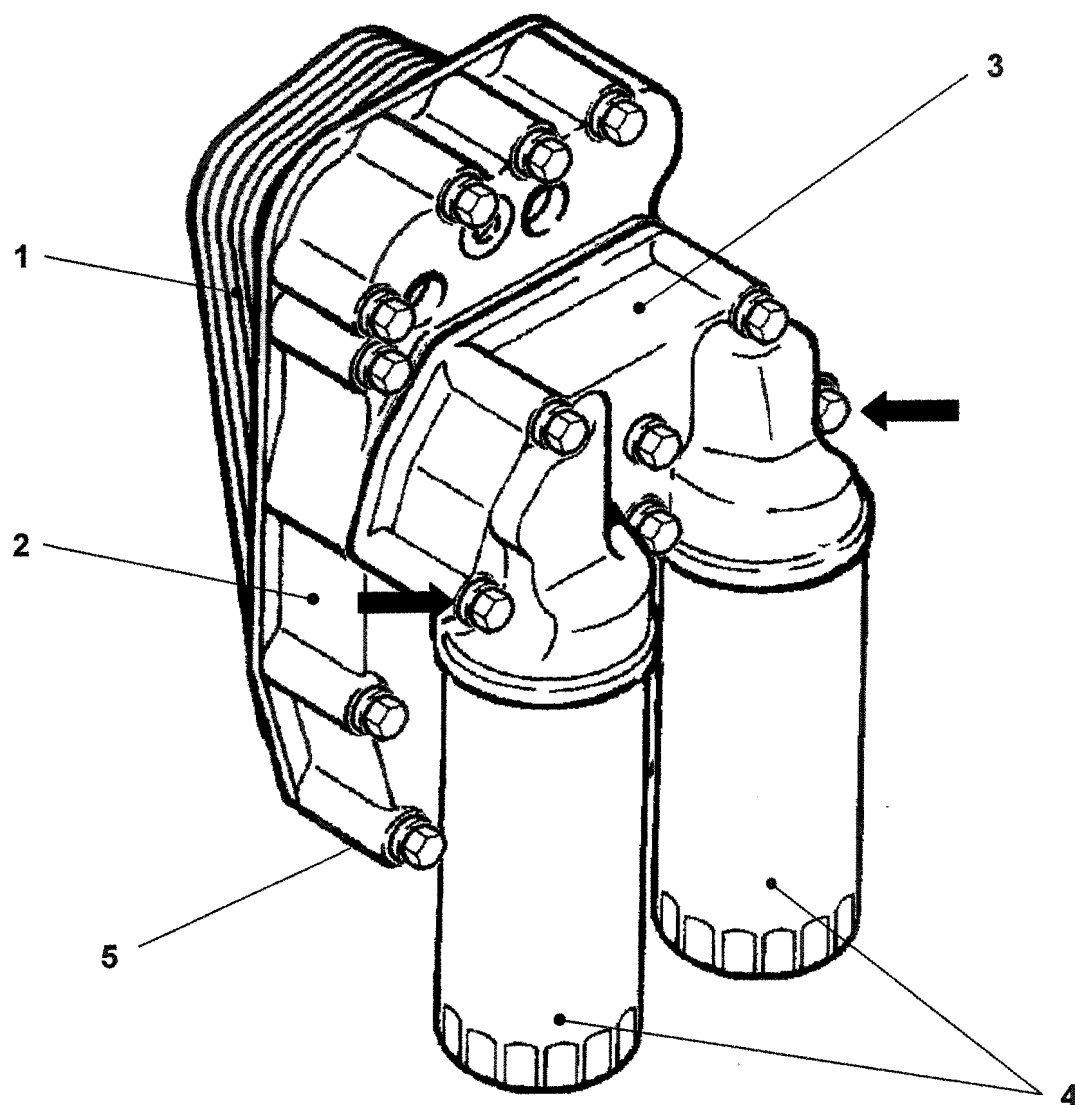
Inset the piston of the bypass valve into the center bore in the crankcase. Install the oil cooler housing 2 with oil cooler 1 and new seal onto the crankcase. Install the lube oil filter 4 onto the oil filter console 3 or the oil lines onto the oil filter housing 2. Install the coolant drain plug 5 and add coolant.

Check the engine oil level, add oil as necessary.

### **Note:**

Depending on the size of the oil cooler, there might be an intermediate plate installed between the oil cooler housing and the crankcase.

# Lube oil filter installed "hanging" from the oil cooler housing



- 1 Oil cooler
- 2 Oil cooler housing
- 3 Oil filter console
- 4 Oil filter
- 5 Coolant drain plug

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

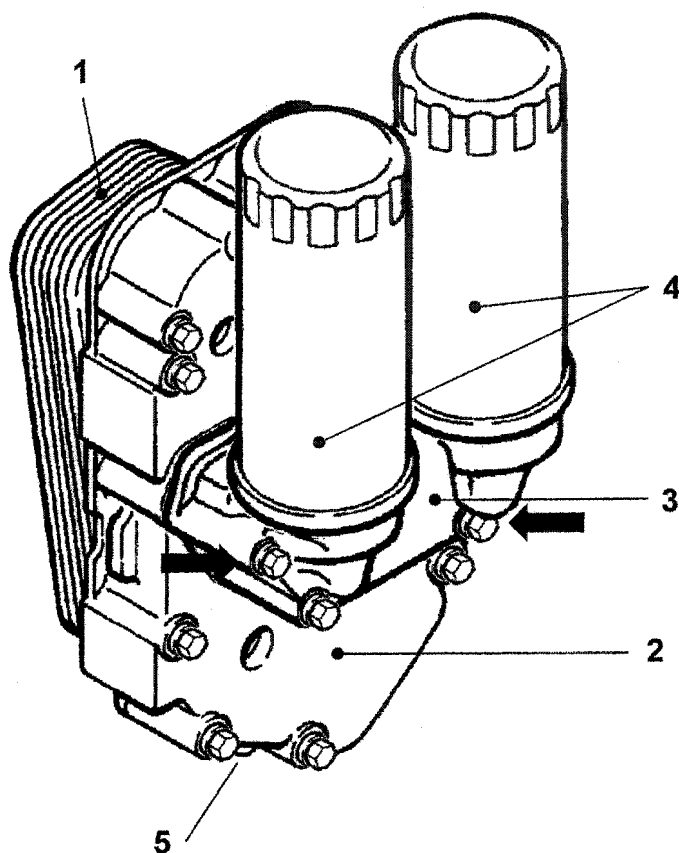
Lube oil filter and oil cooler

Blatt  
Page  
Feuille

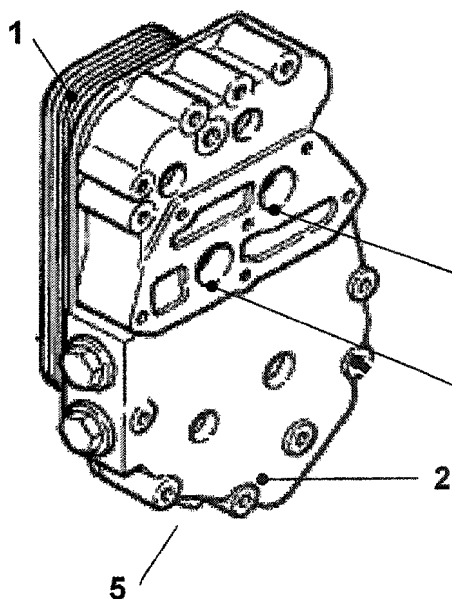
17

## Lube oil filter installed "upright" on the oil cooler housing

- 1 Oil cooler
- 2 Oil cooler housing
- 3 Oil filter console
- 4 Oil filter
- 5 Coolant drain plug



## Lube oil filter installed "away" from the oil cooler housing



- 1 Oil cooler
- 2 Oil cooler housing
- 5 Coolant drain plug

Connection from filter

Connection to filter

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Lube oil filter and oil cooler

Blatt  
Page  
Feuille

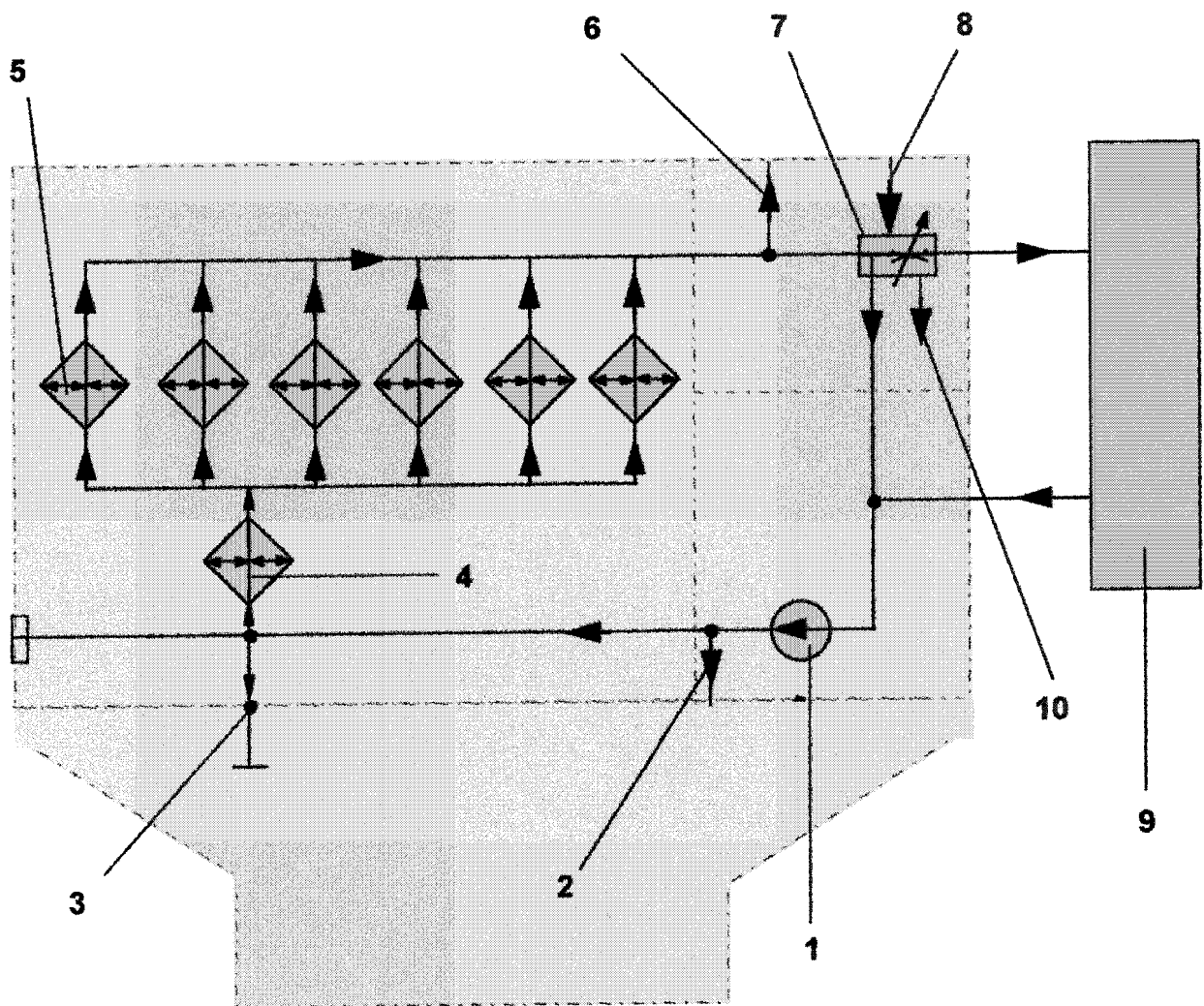
17.1

## **18    Coolant circuit**

Schematic view on D 906, 916, 926 engines.

- 1      Coolant pump**
- 2      Line to heater**
- 3      Coolant drain**
- 4      Oil cooler housing**
- 5      Cylinder liner bushing, cylinder heads**
- 6      Connection for bleeder line**
- 7      Thermostat housing, thermostats**
- 8      Return line from heater**
- 9      Water cooler**
- 10     Water filter**

Opening begin of thermostats = 71°C, 79°C, 83°C



**LIEBHERR**

Benennung / Description / Denomination

Typ Model Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Datum / Edition / Date  
12 / 2003

Coolant circuit

Blatt  
Page  
Feuille

18

## 19 Water filter

To improve the quality of the coolant, water filters are installed on the newer engines or on E-engine.

Due to this measure, the coolant is filtered in the auxiliary flow and is cleared of dirt or rust particles.

In addition, due to a chemical additive in the water filter (DCA 4), the coolant system or any parts which come in contact with the coolant, such as coolant pump, cylinder liners etc. are protected from cavitation, corrosion, scale deposits and foam formation.

Water filters can be installed externally or on the thermostat housing.

For water filter change intervals, see Maintenance and Inspections.

For coolant mixture, see Service Fluids.

### **To change the water filter:**

#### **External installation:**

Close the shut off valves 1, 2. Remove the water filter element 3.

Clean the sealing surface on the filter console.

Install new water filter element 3, lightly lubricate the rubber seal ring with oil, and tighten by hand. Open the shut off valves 1, 2. Check the coolant level, add more coolant as necessary.

#### **Installation on thermostat housing:**

Close the shut off valve 1 on the thermostat housing, bring it from horizontal to vertical position to the water filter.

Remove the water filter element 3.

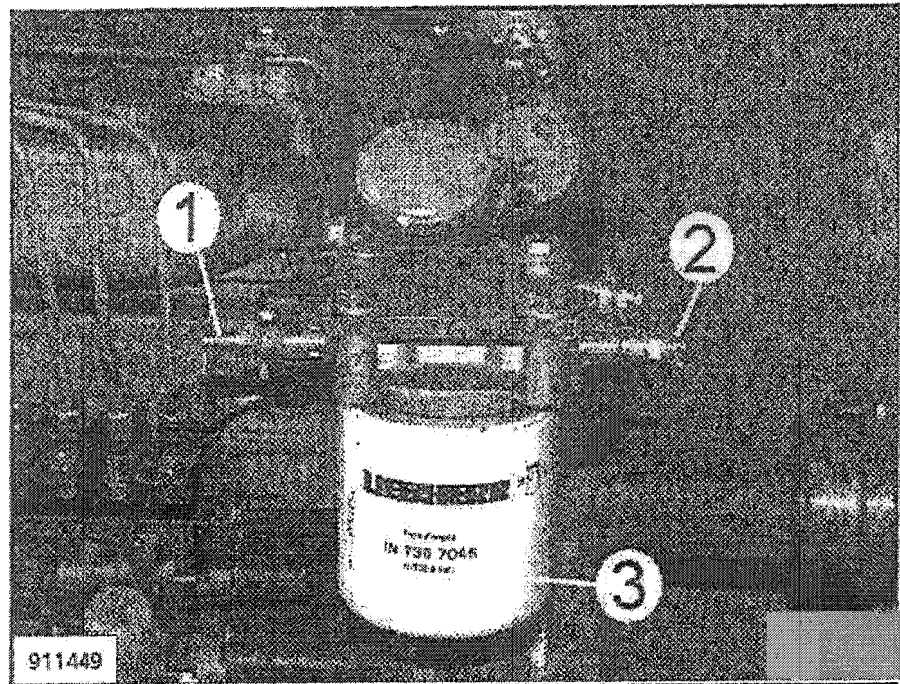
Clean the sealing surface on the filter console.

Install new water filter element 3, lightly lubricate the rubber seal ring with oil, and tighten by hand. Open the shut off valve 1, bringing it from vertical to horizontal position to the water filter. Check the coolant level, add more coolant as necessary.



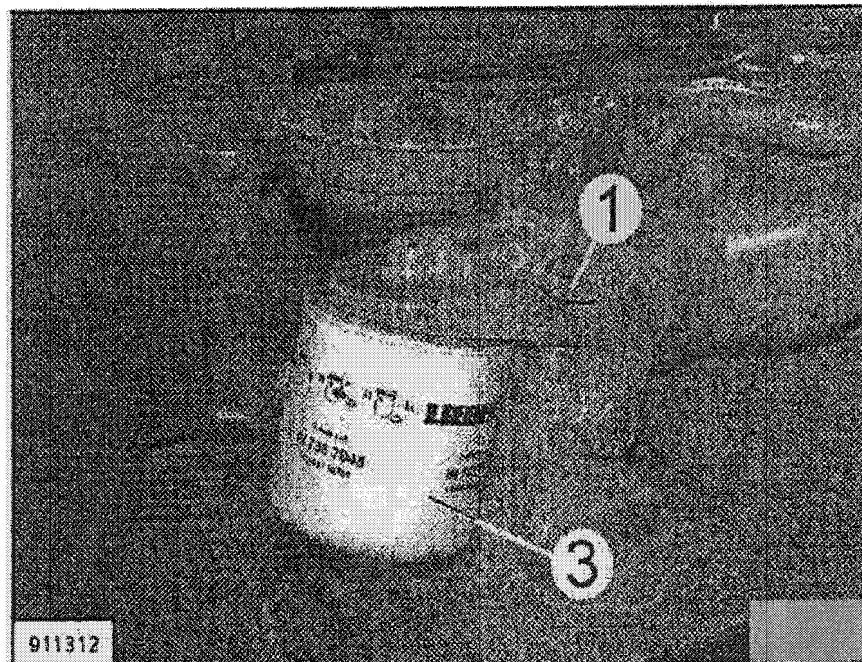
## Water filter installation, external

- 1 Shut off valve
- 2 Shut off valve
- 3 Water filter



## Water filter installation on thermostat housing

- 1 Shut off valve
- 3 Water filter



**LIEBHERR**

Benennung / Description /  
Denomination

Water filter

Typ            D 904 / 914 / 924  
Model        D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Blatt  
Page  
Feuille            19

## 20 Coolant pump

### Coolant pump installed on the timing case

In this version, the fan is installed on the coolant pump.

The coolant pump and the fan is driven by a gear.

RPM:	Engine	n <sup>1</sup> /min	=2000 / 2100
	Coolant pump	n <sup>1</sup> /min	=2312 / 2428

Supply power: approx.. 270 l /min / 2312 <sup>1</sup>/min, approx. 284 l /min / 2428 <sup>1</sup>/min

### Note:

The coolant pump must be replaced or overhauled if increased coolant or oil discharge is found on the leakage bores (see arrows). Oil can only emerge on the leakage bore on the neck of the housing, in front of the timing case.

### Removal:

Drain the coolant, remove the cooler and heater hoses. Remove the cooler, remove the fan 7. Remove the cable on the coolant temperature sensor. Remove the screws 1 on the coolant pump. Only screws 1 with hex head must be removed. Push the coolant pump complete with thermostat housing cover 2 from the timing case or from the coolant collector line.

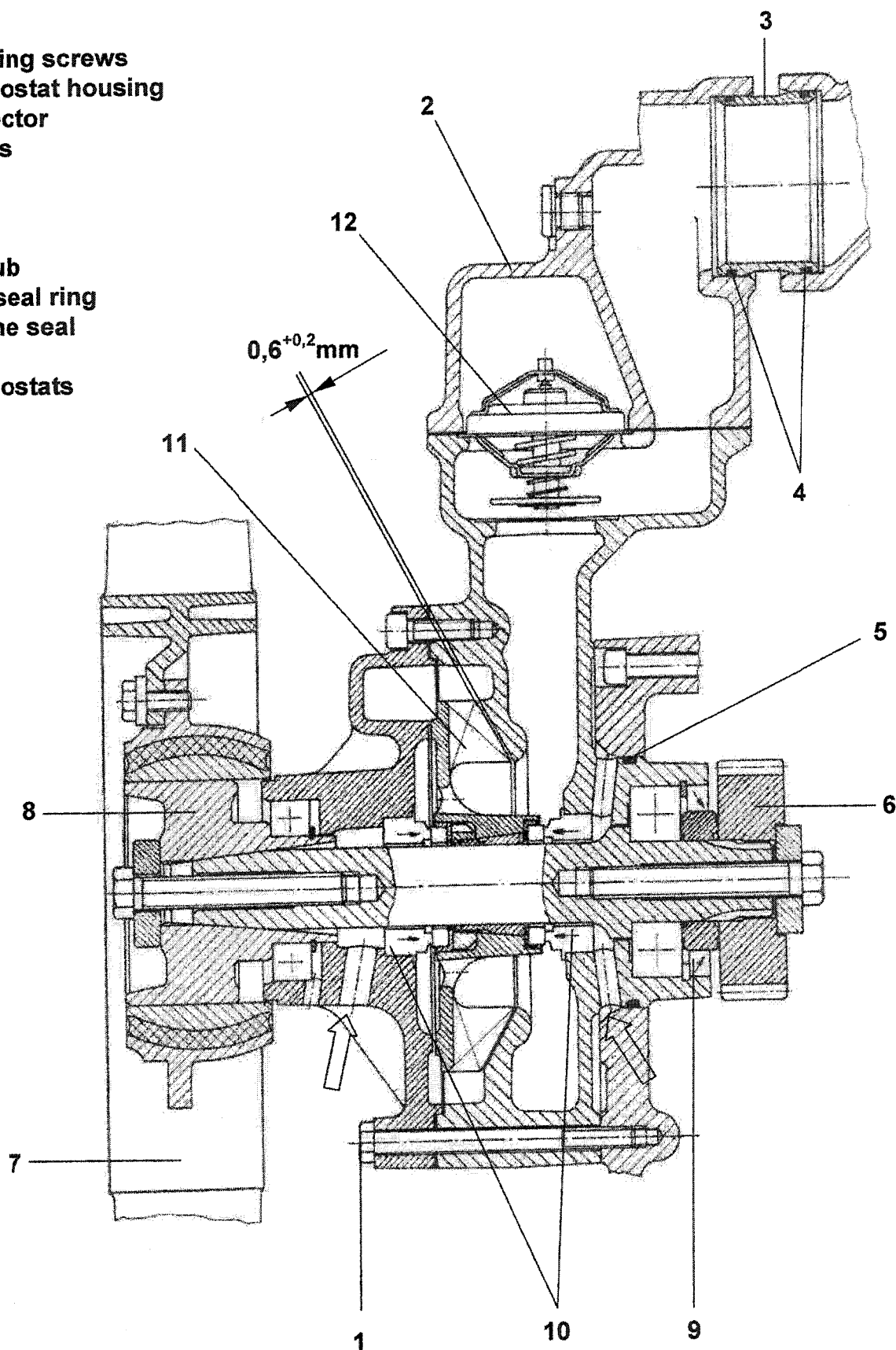
### Installation:

Attach new O-rings 4 to the connector 3. Lightly oil the O-rings and push the connector 3 into the coolant collector line. Place a new O-ring with grease into the groove on the coolant supply intake bore of the coolant pump to the timing case. Install new O-ring 5, lubricate it lightly. Push the coolant pump complete with thermostat housing cover 2 by turning the drive shaft - until gear 6 has engaged - into the timing case or into the connector 3 on the coolant collector line. Turn in screws 1 and tighten. Attach the cable on the sensor, install the fan 7, install the cooler and the cooler and heater hoses. Add coolant.

### Important:

Before operating the coolant pump, make sure that coolant has been added.

- 1 Mounting screws
- 2 Thermostat housing
- 3 Connector
- 4 O-rings
- 5 O-ring
- 6 Gear
- 7 Fan
- 8 Fan hub
- 9 Shaft seal ring
- 10 Lifetime seal
- 11 Idler
- 12 Thermostats



**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Coolant pump

Blatt  
Page  
Feuille 20

## 20.1 Coolant pump

### Coolant pump integrated in the timing case to engine No. 93 01 1641

The coolant pump is driven by a gear.

RPM:	Engine	n <sup>1</sup> /min	=1800 / 2000 / 2100
	Coolant pump	n <sup>1</sup> /min	=3027 / 3363 / 3532

Supply power: approx. 270 l/min / 3027 <sup>1</sup>/min, approx. 300 l/min / 3363 <sup>1</sup>/min  
approx. 315 l/min / 3532 <sup>1</sup>/min

#### Note:

The coolant pump must be replaced or overhauled if increased coolant or oil discharge is found on the leakage bores in the timing case (see arrows).

#### Removal:

Drain the coolant, remove cover 1. Remove screw 2. Remove cover 3 and spacer 4. Pull the coolant pump with the pulling device from the timing case.

#### Installation:

Attach new O-rings 5. Lubricate the coolant pump on the O-rings 5 and on the surface between the O-rings 5 or the intake bore in the timing case with grease (Staburags NBU 12). Push the coolant pump into the timing case in such a way that the thread for the screw 2 in the coolant pump and the bore in the timing case match when the coolant pump is pushed in.

Apply a locking fluid (Loctite 243) to the threads of screw 2 and install with spacer 4 and cover plate 3 and tighten according to torque specifications. Measure the gap between the impeller 3 and the timing case with a feeler gauge. Install cover 1 with new O-ring 7 and add coolant.

**Tightening torque for screw 2 = Nm 15**

**Gap between impeller and timing case = 0.9 - 1,113 mm**

#### Note:

The given dimension is the complete dimension on both sides of the impeller. When checking the dimension with the feeler gauge, use half the value.

#### Check the axial play:

The axial play of the coolant pump must be checked for the first time at 6000 hrs. and then every 3000 hours thereafter.

Drain the coolant, remove the cover 1.

Install a commercially available test gauge holder with test gauge to the shaft of the coolant pump (see arrow) and move the impeller 6 with the screw in one of the two threads in the impeller 6 axially back and forth.

Read the axial play.

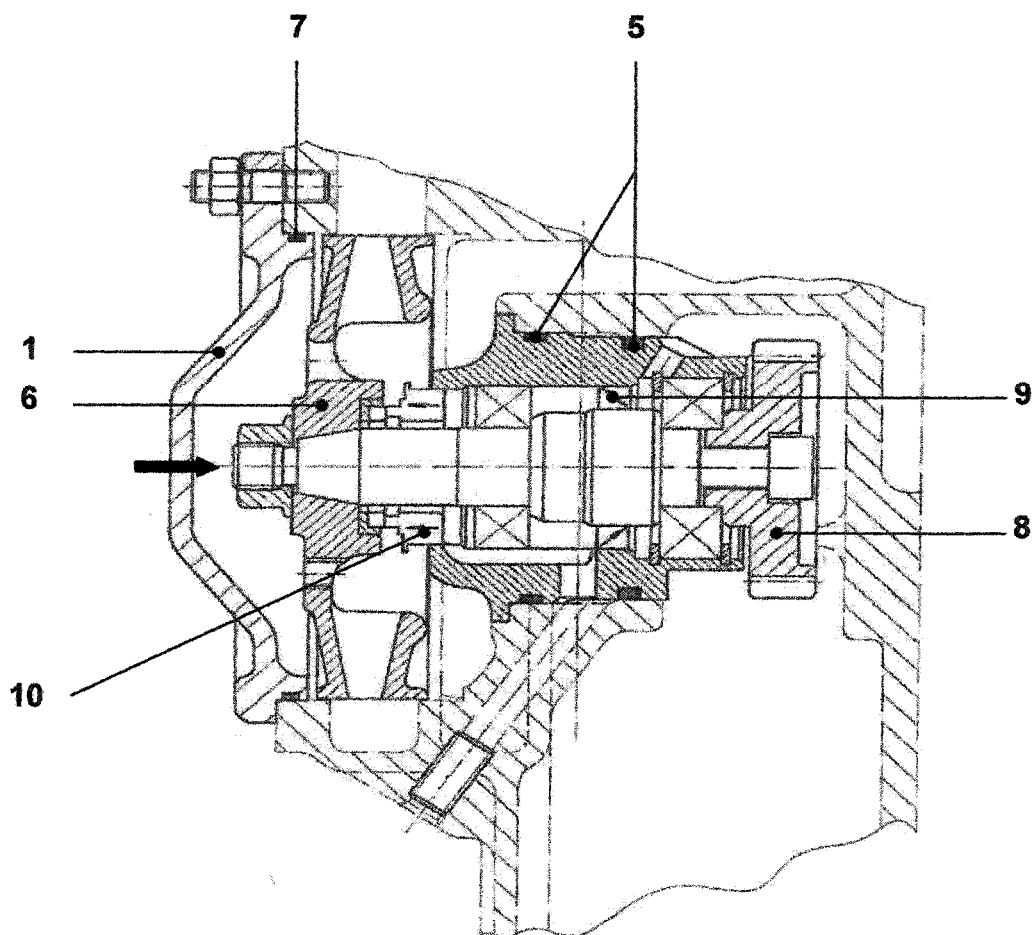
Permissible axial play = 0.1 mm

Limit value = 0.12 mm

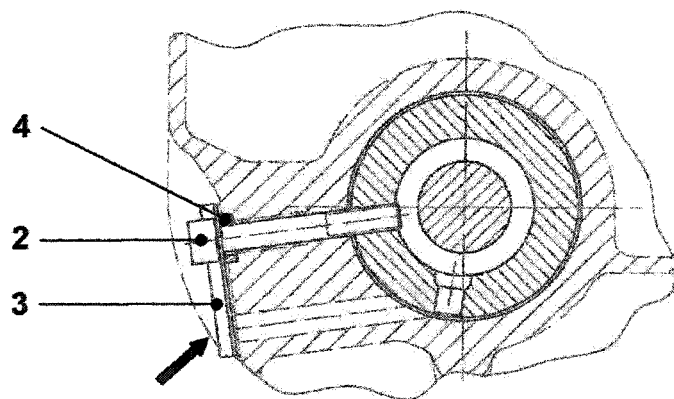
If the given limit value is exceeded, the coolant pump must be replaced.

#### Important:

Before operating coolant pump, make sure that coolant has been added.



- 1 Cover
- 2 Mounting screw
- 3 Cover
- 4 Spacer
- 5 O-rings
- 6 Idler
- 7 O-ring
- 8 Gear
- 9 Shaft seal ring
- 10 Lifetime seal



**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Coolant pump

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page 20.1  
Feuille

## 20.2 Coolant pump

### Coolant pump integrated in timing case

Repair solution to Engine No. 93 01 1641

The coolant pump is driven by a gear.

### Important:

When changing the coolant pump integrated in the timing case until above engine No. (see 20.1), only the repair solution may be used. If the coolant pump is still mounted the old way (see 20.1) then a M 10 x 1 / 20 mm deep thread must be made into the mounting bore in the timing case (see illustration).

RPM:	Engine	n <sup>1</sup> /min 1800 / 2000 / 2100
	Coolant pump	n <sup>1</sup> /min 3027 / 3363 / 3532
Supply power:	approx. 270 l /min / 3027 <sup>1</sup> /min, approx. 300 l /min / 3363 <sup>1</sup> /min approx. 315 l /min / 3532 <sup>1</sup> /min	

### Note:

The coolant pump must be replaced or overhauled if increased coolant or oil discharge is found on the leakage bores in the timing case (see arrows).

### Removal:

Drain the coolant, remove cover 1. Counter screw 2 and loosen the locknut 3. Remove screw 2 along with cover 4 and spacer 5.

Pull the coolant pump with the pulling device from the timing case.

### Installation:

Install new O-rings 6. Lubricate the coolant pump on the O-rings 6 and on the surface between the O-rings 6 or the intake bore in the timing case with grease (Staburags NBU 12). Push the coolant pump into the timing case in such a way that the bore in the coolant pump and the bore or the thread for the mounting screw match when the coolant pump is pushed in.

Apply a locking fluid (Loctite 243) to the threads of screw 2 and install with spacer 5 and cover plate 4 and tighten according to torque specifications. Bring the cover plate 4 into the correct position to the leakage bore. Counter the screw 2 and tighten the locknut 3. Measure the gap between the impeller 4 and the timing case with a feeler gauge. Install cover 1 with new O-ring 8 and add coolant.

**Tightening torque for screw 2 = Nm 15**

**Gap between impeller and timing case = 0.9 - 1,113 mm**

### Note:

The given dimension is the complete dimension on both sides of the impeller. When checking the dimension with the feeler gauge, use half the value.

### Check the axial play:

The axial play of the coolant pump must be checked the first time at 6000 hours and then every 3000 hours thereafter.

Drain the coolant, remove cover 1.

Install a commercially available dial gauge holder with dial gauge on the shaft of the coolant pump (see arrow) and move the idler 7 back and forth with a screw which was inserted in one of the two threads in the idler 7. Read the axial play.

Permissible axial play = 0.1 mm

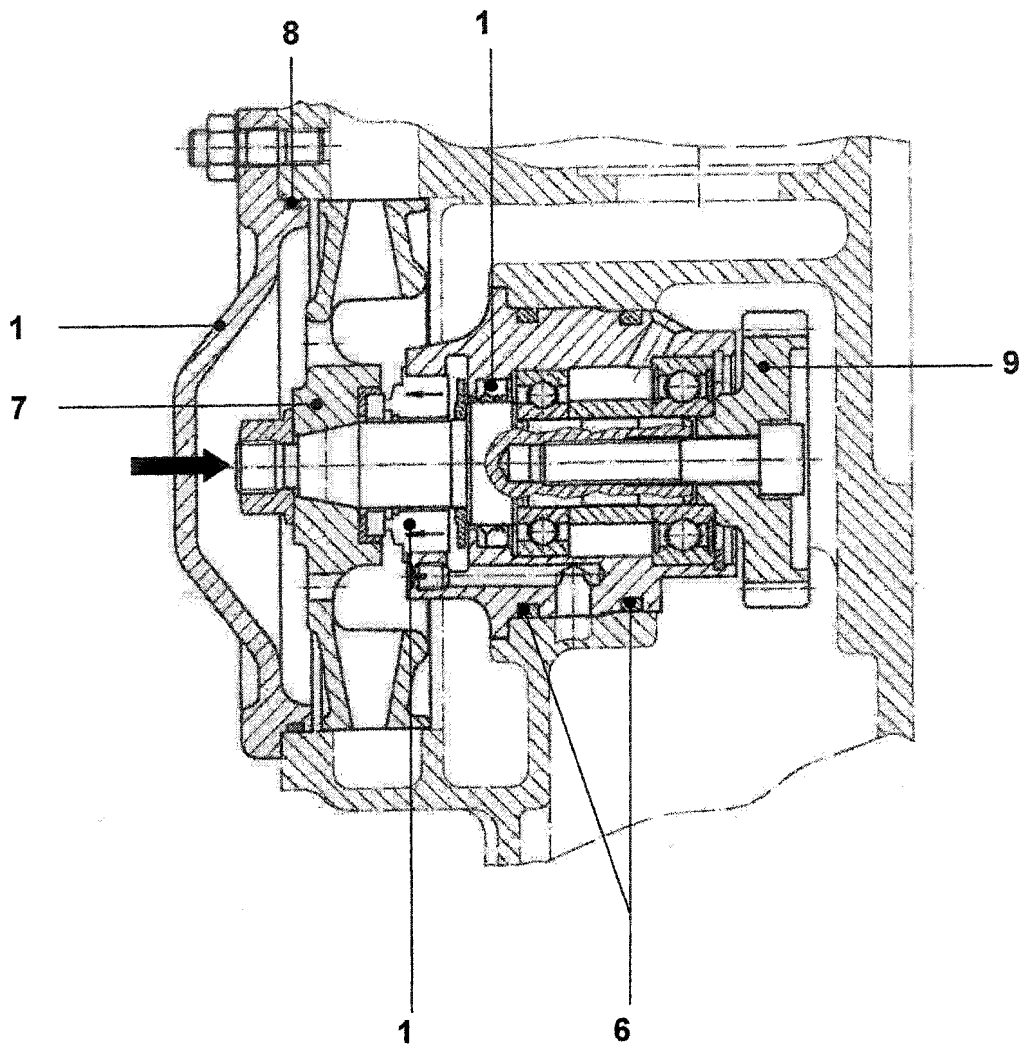
Limit value = 0.12 mm

If the given limit value is exceeded, then the coolant pump must be replaced.

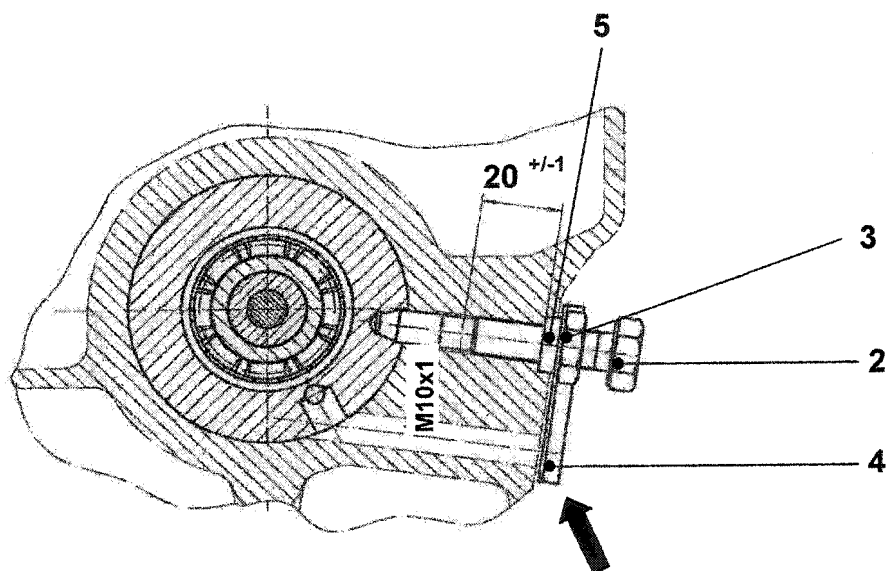
### **Important:**

Before operating coolant pump, make sure that coolant has been added.

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ      D 904 / 914 / 924 Model    D 906 / 916 / 926 Type
Datum / Edition / Date 12 / 2003	Coolant pump	Blatt Page      20.2 Feuille



- 11 Cover
- 12 Mounting screw
- 13 Lock nut
- 14 Cover plate
- 15 Spacers
- 16 O-rings
- 17 Idler
- 18 O-ring
- 19 Gear
- 20 Shaft seal ring
- 21 Lifetime seal



**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Coolant pump

Blatt  
Page  
Feuille

20.2



## 20.3 Coolant pump

### Coolant pump integrated in timing case

from engine No. 93 01 1642

The coolant pump is driven by a gear.

RPM:	Engine	n <sup>1</sup> /min 1500 / 1800 / 2000 / 2100
	Coolant pump	n <sup>1</sup> /min 2523 / 3027 / 3363 / 3532
Supply power:	approx. 225 l/min / 2523 <sup>1</sup> /min, approx. 270 l/min / 3027 <sup>1</sup> /min	
	approx. 300 l/min / 3363 <sup>1</sup> /min, approx. 315 l/min / 3532 <sup>1</sup> /min	

### Note:

The coolant pump must be replaced or overhauled if increased coolant or oil discharge is found on the leakage bores in the timing case (see arrows).

### Removal:

Drain the coolant, remove cover 1. Remove screw 2 and pull the coolant pump with the pulling device from the timing case.

Remove screw 3, remove cover plate 4 and spacer 5. Clean the threaded bore and the leakage bore.

### Installation:

Install spacer 5, cover plate 4 and screw 3. Install new O-rings 6. Lubricate the coolant pump on the O-rings 6 and on the surface between the O-rings 6 or the intake bore in the timing case with grease (Staburags NBU 12) . Push the coolant pump into the timing case in such a way that the recess in the coolant pump housing and the positioning screw in the timing case match when the coolant pump is pushed in.

Apply a locking fluid (Loctite 243) to the threads of screw 2, install tighten according to torque specifications.

Measure the gap between the impeller 7 and the timing case with a feeler gauge. Install cover 1 with new O-ring 8 and add coolant.

**Tightening torque for screw 2 = Nm 15**

**Gap between impeller and timing case = 0.9 - 1,113 mm**

### Note:

The given dimension is the complete dimension on both sides of the impeller. When checking the dimension with the feeler gauge, use half the value.

### Check the axial play:

The axial play of the coolant pump must be checked the first time at 6000 hours and then every 3000 hours thereafter.

Drain the coolant, remove cover 1.

Install a commercially available dial gauge holder with dial gauge on the shaft of the coolant pump (see arrow) and move the idler 7 back and forth with a screw which was inserted in one of the two threads in the idler 7. Read the axial play.

Permissible axial play = 0.1 mm

Limit value = 0.12 mm

If the given limit value is exceeded, then the coolant pump must be replaced.

### **Important:**

Before operating coolant pump, make sure that coolant has been added.

**LIEBHERR**

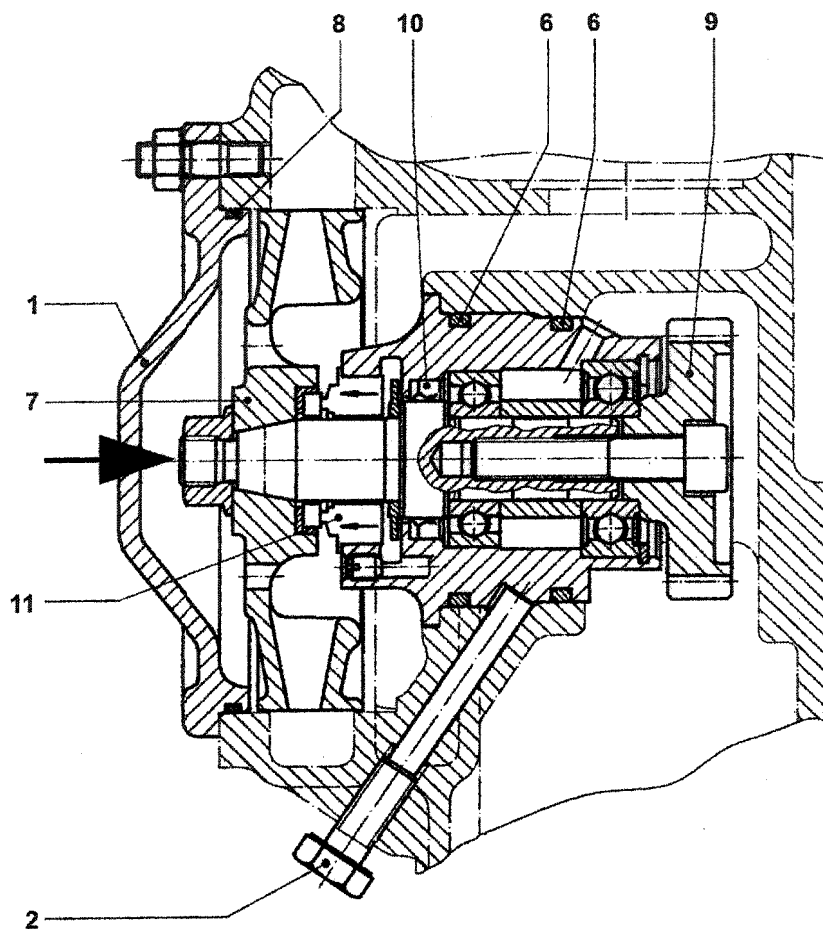
Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Coolant pump

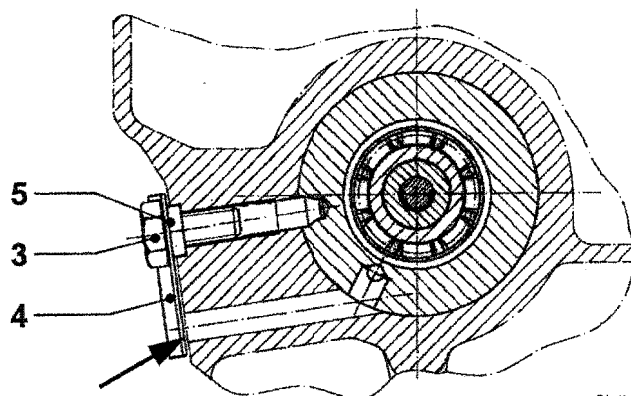
Typ            D 904 / 914 / 924  
Model        D 906 / 916 / 926  
Type

Blatt  
Page            20.3  
Feuille



Blatt 20-3-1

- 1 Cover
- 2 Mounting screw
- 3 Screw
- 4 Cover plate
- 5 Spacer
- 6 O-ring
- 7 Idler
- 8 O-ring
- 9 Gear
- 10 Shaft seal ring
- 11 Lifetime seal



Blatt 20-3-2

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Coolant pump

Blatt  
Page  
Feuille 20.3

## 20.4 Coolant pump

### Coolant pump integrated in timing case

#### With collar bearing (bushings)

up to engine nr. 2001 02 1093

The coolant pump is driven by a gear.

RPM:	Engine	n <sup>1</sup> /min 1500 / 1800 / 2000 / 2100
	Coolant pump	n <sup>1</sup> /min 2523 / 3027 / 3363 / 3532

Supply power: approx. 225 l/min / 2523 <sup>1</sup>/min, approx. 270 l/min / 3027 <sup>1</sup>/min  
approx. 300 l/min / 3363 <sup>1</sup>/min, approx. 315 l/min / 3532 <sup>1</sup>/min

#### **Note:**

The coolant pump must be replaced or overhauled if increased coolant or oil discharge is found on the leakage bores in the timing case (see arrows).

#### **Removal:**

Drain the coolant, remove cover 1. Remove the hollow screw 2 and remove the cover 3. Remove the lube oil line 4 on the crankcase. Loosen the mounting screw 5 (lube oil nozzle) and remove. Pull the coolant pump with the pulling device from the timing case. Clean the threaded bore and the leakage bore.

#### **Installation:**

Install new O-rings 6. Lubricate the coolant pump on the O-rings 6 and on the surface between the O-rings 6 or the intake bore in the timing case with grease (Staburags NBU 12). Push the coolant pump into the timing case in such a way that the recess in the coolant pump housing and the positioning screw in the timing case match when the coolant pump is pushed in. Apply a locking fluid (Loctite 243) to the threads of mounting screw 5 (lube oil nozzle), install and tighten according to torque specifications. Install the cover plate 3 and hollow screw 2 with new O-ring and tighten everything. Measure the gap between the impeller 7 and the timing case with a feeler gauge. Install cover 1 with new O-ring 8 and add coolant.

**Tightening torque for screw 5 = Nm 20**

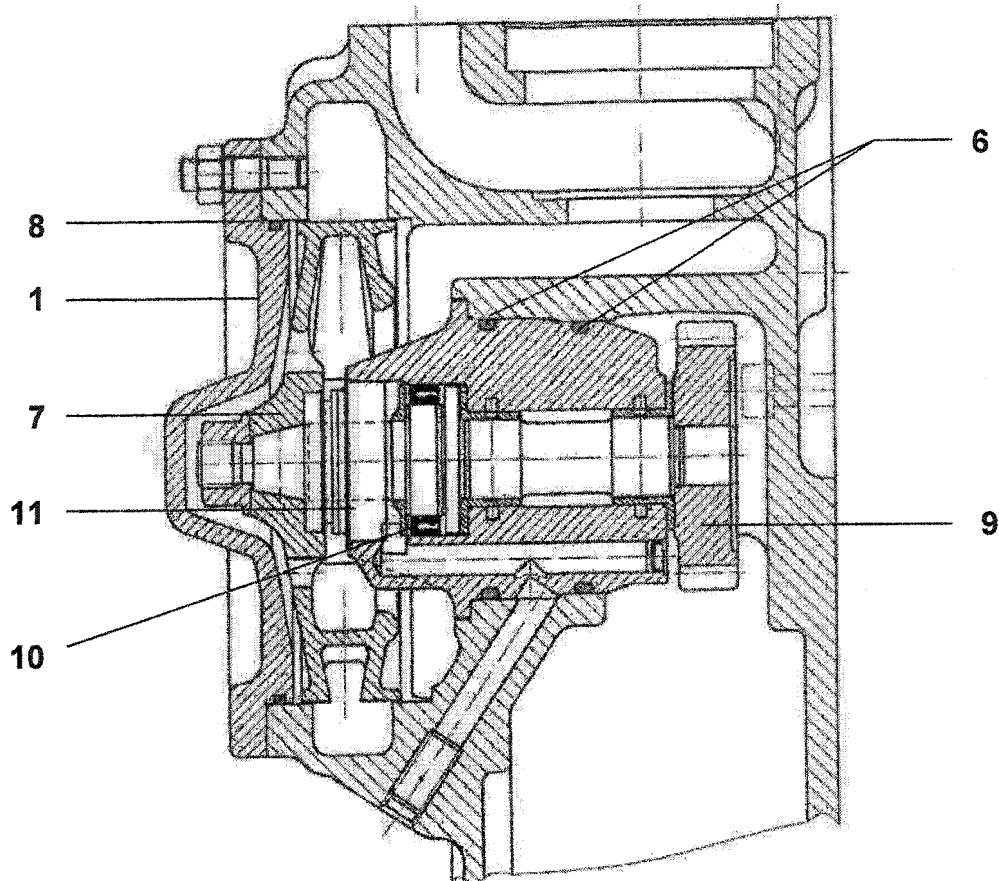
**Gap between impeller and timing case = 0.9 - 1,113 mm**

#### **Note:**

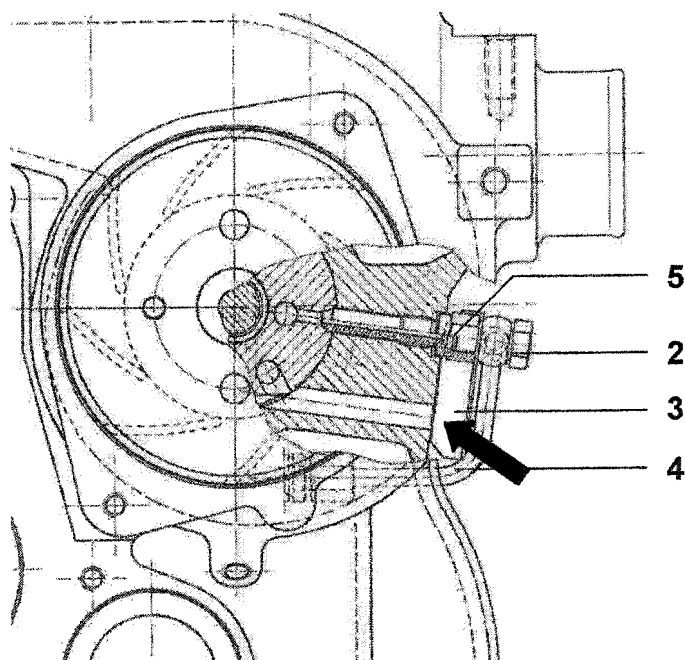
The given dimension is the complete dimension on both sides of the impeller. When checking the dimension with the feeler gauge, use half the value.

#### **Important:**

Before operating coolant pump, make sure that coolant has been added.



- 1 Cover
- 2 Hollow screw
- 3 Cover plate
- 4 Lube oil line
- 5 Mounting screw (lube oil nozzle)
- 6 O-rings
- 7 Idler
- 8 O-ring
- 9 Gear
- 10 Shaft seal ring
- 11 Lifetime seal



**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Coolant pump

Blatt  
Page  
Feuille

20.4

## 20.5 Coolant pump

### Coolant pump integrated in timing case With collar bearing ( bushings)

From engine No. 2001 02 1094

The coolant pump is driven by a gear.

RPM:	Engine	n <sup>1</sup> /min 1500 / 1800 / 2000 / 2100
	Coolant pump	n <sup>1</sup> /min 2523 / 3027 / 3363 / 3532

Supply power: approx. 225 l / min / 2523 <sup>1</sup>/min, approx. 270 l / min / 3027 <sup>1</sup>/min  
approx. 300 l / min / 3363 <sup>1</sup>/min, approx. 315 l / min / 3532 <sup>1</sup>/min

#### Note:

The coolant pump must be replaced or overhauled if increased coolant or oil discharge is found on the leakage bores in the timing case (see arrows).

#### Removal:

Drain coolant, remove cover 1. Remove the hollow screw 2 and remove the lube oil line 3 on the crankcase. Loosen the mounting screw 4 ( lube oil nozzle ) and remove with cover plate 5. Pull the coolant pump with the pulling device from the timing case. Clean the threaded bore and the leakage bores.

#### Installation:

Install new O-rings 6. Lubricate the coolant pump on the O-rings 6 and on the surface between the O-rings 6 or the intake bore in the timing case with grease (Staburags NBU 12).

Push the coolant pump into the timing case in such a way that the recess in the coolant pump housing and the positioning screw in the timing case match when the coolant pump is pushed in.

Apply a new O-ring 7 to the mounting screw 4 (lube oil nozzle) and apply a retention fluid (Loctite 243 ) to the threads, install cover plate 5 and tighten according to torque specifications.

Measure the distance "A" between the installation surface cover 1 and the outer impeller 8 with a depth gauge.

#### Note:

The coolant pump is installed correctly if the noted gab is retained.

Install the lube oil line 3 with new seal rings to the mounting screw 4 (lube oil nozzle) and install on the crankcase.

Measure the gab between the impeller 8 and the bore in the timing case with a feeler gauge. Install cover 1 with new O-ring 9 and add coolant.

#### Tightening torque for mounting screw 4

= Nm 20

#### Distance "A" between the installation surface cover 1 and the outer impeller 8

= 9,2 + 1,3 / - 1 mm

#### Gap between the impeller 8 and the bore in the timing case

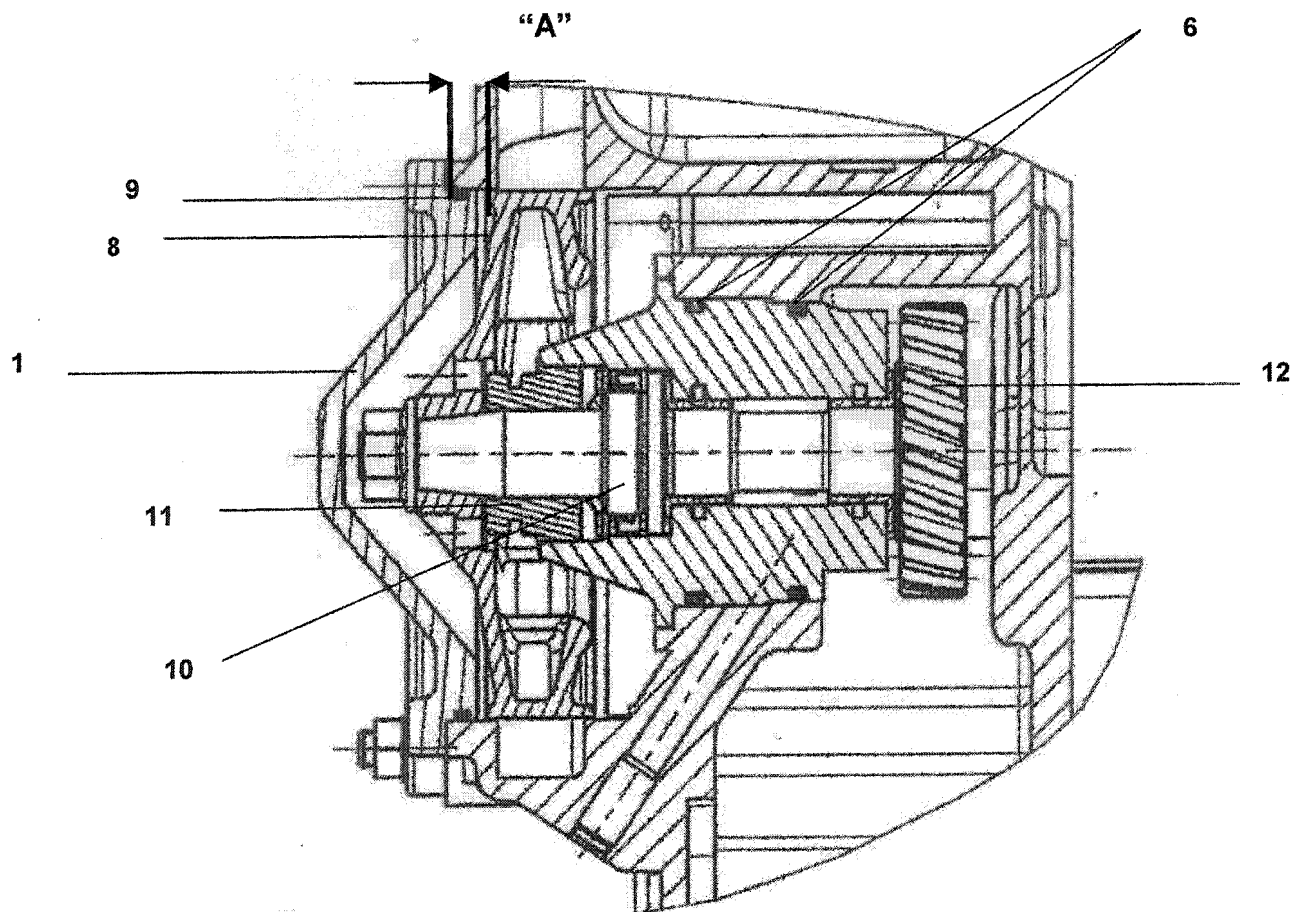
= 0,9 – 1,113 mm

#### Note:

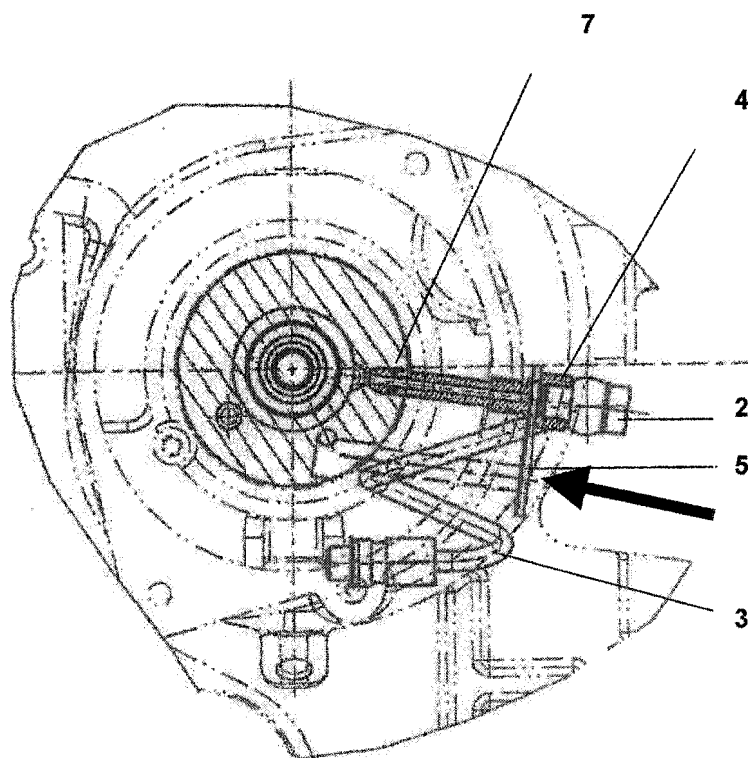
The given dimension is the complete dimension on both sides of the impeller. When checking the dimension with the feeler gauge, use half the value.

#### Caution:

Make sure that coolant has been added before operating the coolant pump.



1. Cover
2. Hollow screw
3. Lube oil line
4. Mounting screw (lube oil Nozzle)
5. Cover plate
6. O-rings
7. O-ring
8. Idler
9. O-ring
10. Shaft seal ring
11. Slipping Seal
12. Gear



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /

Coolant pump

Typ  
Model  
Type

D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille

20.5

## 21 Fan drive

The fan can be driven on the engine with a gear drive, gear drive and fan coupling or Visco coupling.

### Drive with gear

Bearing with ball bearing, to engine No. 89 01 2496

### Removal and disassembly:

Loosen nuts 1 and remove. Remove the fan drive from the timing case. Remove screws 2 and remove with washer 3.

Pull gear 4 with commercially available puller from shaft 5. Release the snap rings 6 and 7.

Knock shaft 5 with ball bearing 8 from housing 9.

Drive the ball bearing 10 or the two row ball bearing 11 from housing 9 with a mandrel.

Drive out shaft seal ring 12 with a mandrel.

### Assembly and installation:

Press new shaft seal ring 12 into housing 9. Lubricate the sealing lip lightly with oil. Push the ball bearing 10 or the two row ball bearing 11 into housing 9. Insert the snap ring 7. Apply retaining fluid ( Omnivisc 1002 or Loctite-Silicon transparent) to the seat for the ball bearing 8 in housing 9.

On shaft 5, apply retaining fluid (Loctite 638) to the seat for ball bearing 10, 11 and push the shaft 5 with ball bearing 8 into housing 9.

Insert snap ring 6. Push the gear 4 onto shaft 5. Insert the screw 2 with washer 3 and tighten according to torque specification.

Install new O-ring 13 and lubricate it lightly with oil. Push the fan drive into the timing case.

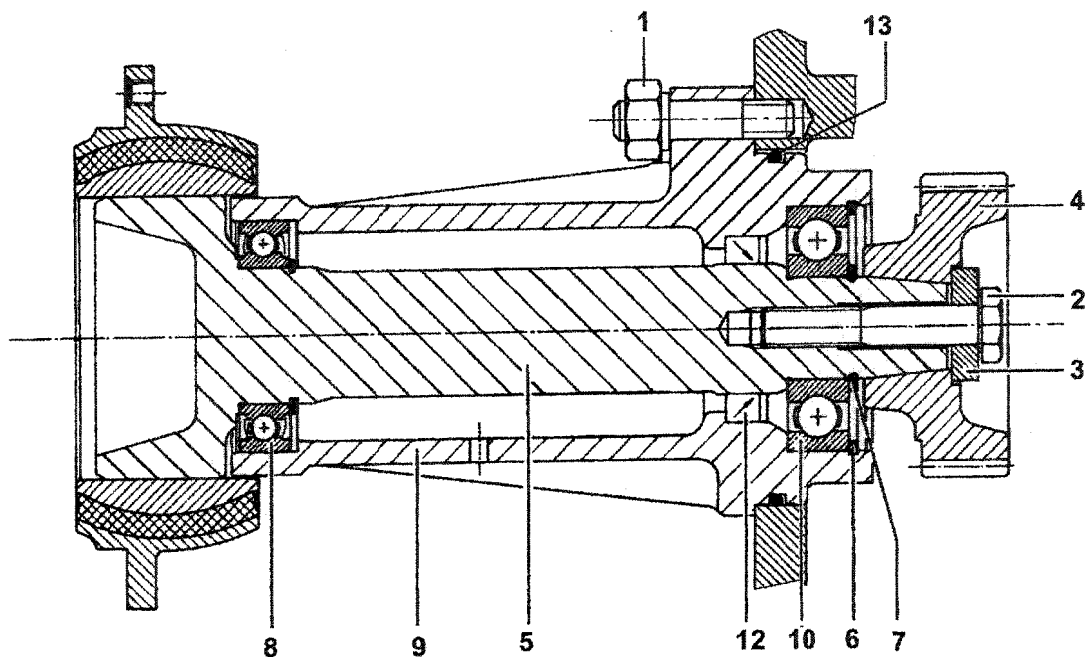
Note the tooth mesh!

Install nut 1 and tighten.

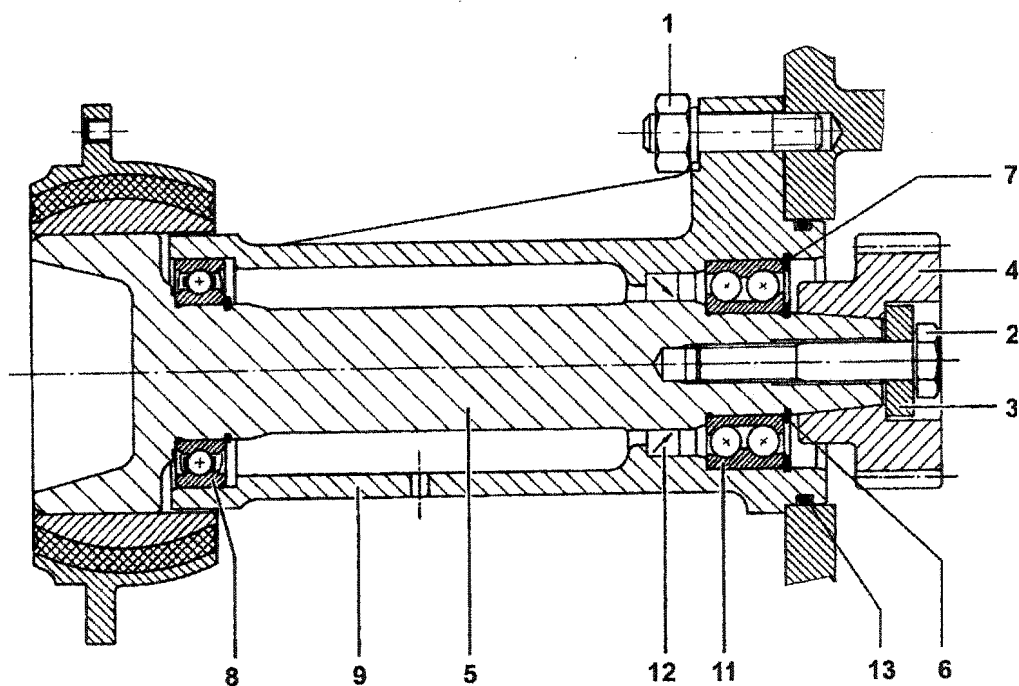
### Tightening torque for screw 2:

Pretorque Nm 30  $\pm$  50  
Nm 120





910436-1



910436-2

- |              |                    |
|--------------|--------------------|
| 7 Nuts       | 7 Snap ring        |
| 8 Screw      | 8 Ball bearing     |
| 9 Washer     | 9 Housing          |
| 10 Gear      | 10 Ball bearing    |
| 11 Shaft     | 11 Ball bearing    |
| 12 Snap ring | 12 Shaft seal ring |
|              | 13 O- ring         |

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Fan drive

Blatt  
Page  
Feuille

21

## 21.1 Fan drive

### Drive with gear

Bearing with ball bearing, from engine No. 89 01 2497

### Removal and disassembly:

Loosen nuts 1 and remove. Remove the fan drive from the timing case. Remove screws 2 and remove with washer 3.

Remove gear 4 from shaft 5. Release the snap ring 6. Knock shaft 5 with ball bearing 7 from housing 8.

Drive the ball bearing 9 or the two row ball bearing 10 from housing 8 with a mandrel.

Drive out shaft seal ring 11 with a mandrel.

### Assembly and installation:

Press new shaft seal ring 11 into housing 8. Lubricate the sealing lip lightly with oil. Push the ball bearing 9 or the two row ball bearing 10 into housing 8. Insert the snap ring 6. Apply retaining fluid (Omnivisc 1002 or Loctite-Silicon transparent) to the seat for the ball bearing 7 in housing 8. Push shaft 5 with ball bearing 7 into housing 8.

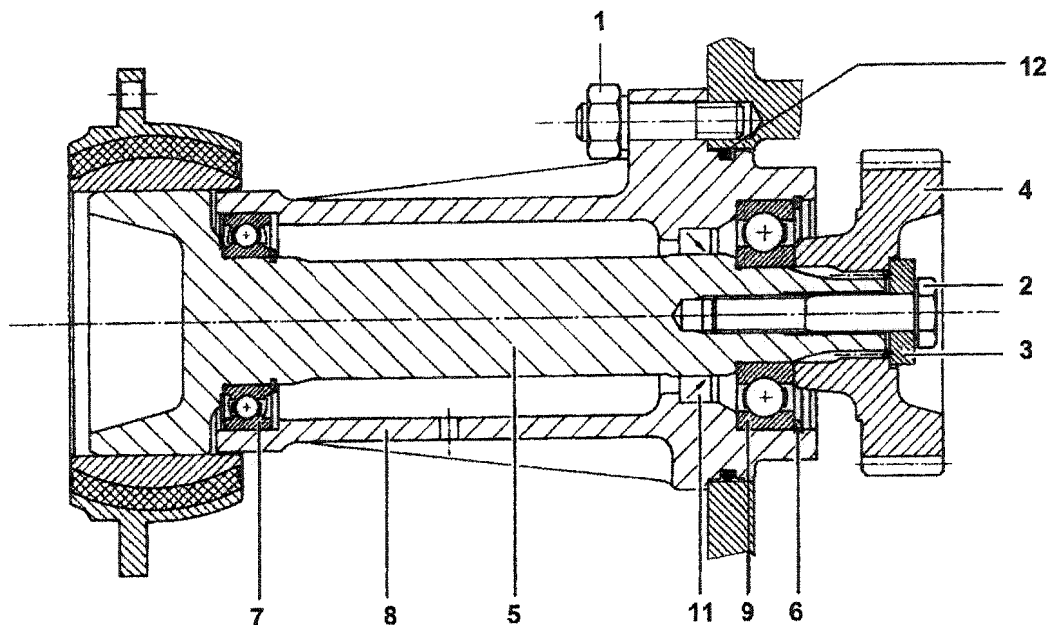
Push the gear 4 onto shaft 5. Insert the screw 2 with washer 3 and tighten according to torque specification.

Install new O-ring 12 and lubricate it lightly with oil. Push the fan drive into the timing case.

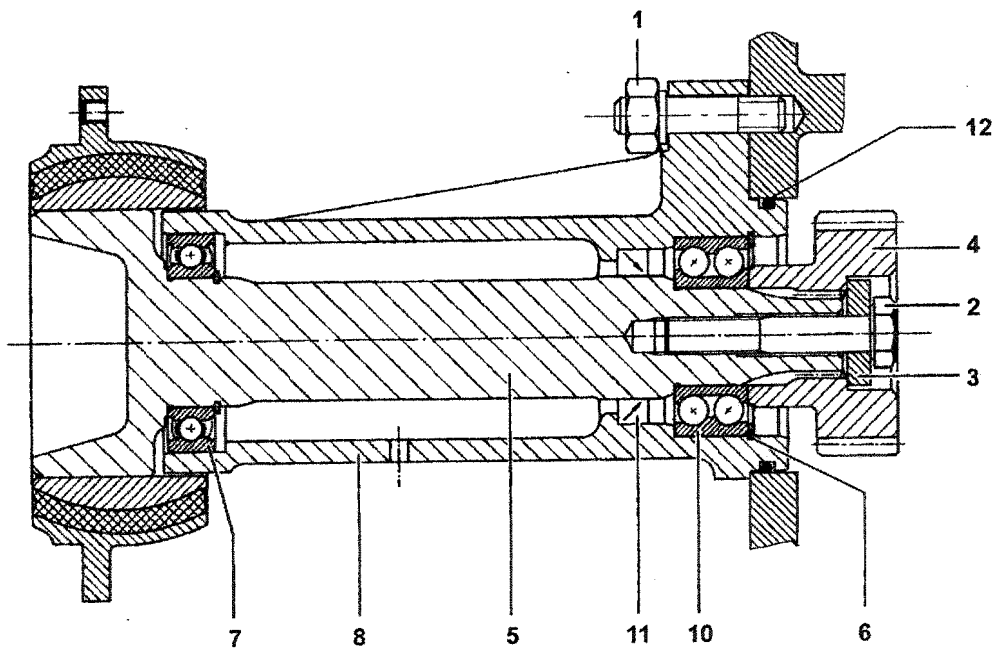
Note the tooth mesh!

Install nut 1 and tighten.

<b>Tightening torque for screw 2: Pretorque</b>	Nm 30	⚙° 50
		Nm 120



910352-1



910352-2

- |             |                    |
|-------------|--------------------|
| 1 Nuts      | 7 Ball bearing     |
| 2 Screw     | 8 Housing          |
| 3 Washer    | 9 Ball bearing     |
| 4 Gear      | 10 Ball bearing    |
| 5 Shaft     | 11 Shaft seal ring |
| 6 Snap ring | 12 O- ring         |

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Fan drive

Blatt  
Page 21.1  
Feuille

## 21.2 Fan drive

**Fan coupling 2 -stage and 3-stage, drive with gear and bearing with ball bearing.**

### **Removal and installation of fan from fan coupling (3-stage):**

Remove nuts 1, push cooling fin ring 2 off. Remove screws on magnetic ring 3 and remove the magnetic ring 3. Remove nuts 4 and remove the fan.  
Install in reverse order.

### **Note:**

If the fan drive speed cannot be reached, for example due to a power supply problem, etc., the fan coupling can be mechanically blocked. Insert two screws 5 (M 6 x 10) tightly through the angle in the threads in the cooling fin ring.

### **Removal and disassembly:**

Remove the cable 6 from the distributor point. Loosen nuts 7 and remove. Remove fan drive from timing case. Remove screw 8, remove washer 9 and remove the fan hub 10 with fan coupling 11 from the bearing housing 12 or from the fan shaft 13. Remove screw 14 and remove with washer 15. Remove gear 16. Drive fan shaft 13 with ball bearing 17, 18 from bearing housing 12. Release snap ring 19 and hit ball bearing 20 from bearing housing 12 with a mandrel. Also drive out the shaft seal ring 21 with a mandrel.

### **Note:**

To disassemble and assemble the fan drive, we recommend to loosen and tighten screw 8 on the fan drive installed on the engine, while holding the ring gear on the flywheel.

### **Assembly and installation:**

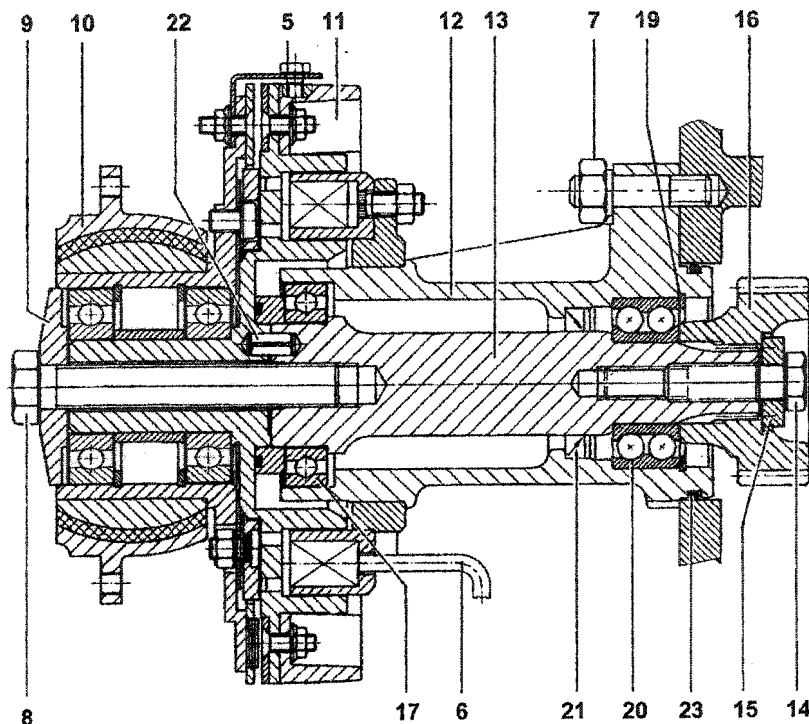
Press in new shaft seal ring 21 into the bearing housing 12. Grease the sealing and protective lip lightly. Push in the ball bearing 20 and engage the snap ring 19. Guide the fan shaft 13 into the bearing housing 12 and push through the shaft seal ring 21 and ball bearing 20 to the stop. Set the gear 16 onto the fan shaft 13. Insert screw 14 with washer 15 and tighten according to torque specification. Press the ball bearing 17, 18 over the fan shaft 13 into the bearing housing 12. Set the fan coupling 11 with fan hub onto the fan shaft 13, noting the pin 22. Attach the washer 9. Turn in the screw 8 and tighten according to torque specification. Attach new O-ring 23 and lubricate it lightly with oil. Push the fan drive into the timing case, noting the gear mesh. Attach nuts 7 and tighten. Connect the cable 6 to the distributor point.

<b>Tightening torque for screw 14:</b>	Pretorque	Nm 30	↗ 50 Nm 120
--	-----------	-------	----------------

<b>Tightening torque for screw 8 (2-stage):</b>	Pretorque	Nm 30	Nm 270
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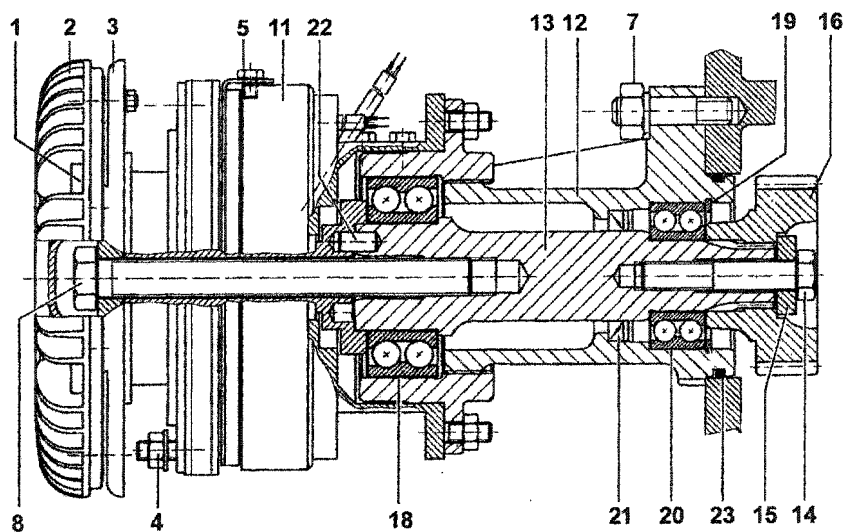
<b>Tightening torque for screw 8 (3-stage):</b>			Nm 180
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## Fan coupling, 2-stage



910413-1

## Fan coupling, 3-stage



910414-1

- |                    |                    |                 |                    |
|--------------------|--------------------|-----------------|--------------------|
| 1 Nuts             | 7 Nuts             | 18 Fan shaft    | 13 Snap ring       |
| 2 Coolant fin ring | 8 Screw            | 19 Screw        | 14 Ball bearing    |
| 3 Magnetic ring    | 9 Washer           | 20 Washer       | 15 Shaft seal ring |
| 4 Nuts             | 10 Fan hub         | 21 Gear         | 16 Pin             |
| 5 Screws           | 11 Fan coupling    | 22 Ball bearing | 17 O-ring          |
| 6 Cable            | 12 Bearing housing | 23 Ball bearing |                    |

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Fan drive

Blatt  
Page  
Feuille  
21.2

## 21.3 Fan drive

### Fan coupling 2-stage and 3-stage, drive with gear and bearing with collar bearing

For removal and installation of fan from fan coupling (3-stage), see page 21.2.

#### Note:

If the fan drive speed cannot be reached, for example due to a power supply problem, etc., the fan coupling can be mechanically blocked. Insert two screws 1 (M 6 x 10) tightly through the angle in the threads in the cooling fin ring.

#### Removal and disassembly:

Remove the cable 2 from the distributor point. Loosen nuts 3 and remove. Remove fan drive from timing case.

Remove screw 4, remove washer 5 and remove the fan hub 6 with fan coupling 7 from the bearing housing 8 or from the fan shaft 9.

Pull the fan shaft 9 from the bearing housing 8 and lift out the shaft seal ring 10.

#### Note:

To disassemble and assemble the fan drive, we recommend to loosen and tighten screw 4 on the fan drive installed on the engine, while holding the ring gear on the flywheel.

#### Assembly and installation:

Press in new shaft seal ring 10 into the bearing housing 8. Lubricate the sealing and protective lip lightly with grease (Barrierta L 55/3).

Lubricate the fan shaft 9 and push it into the bearing housing 8.

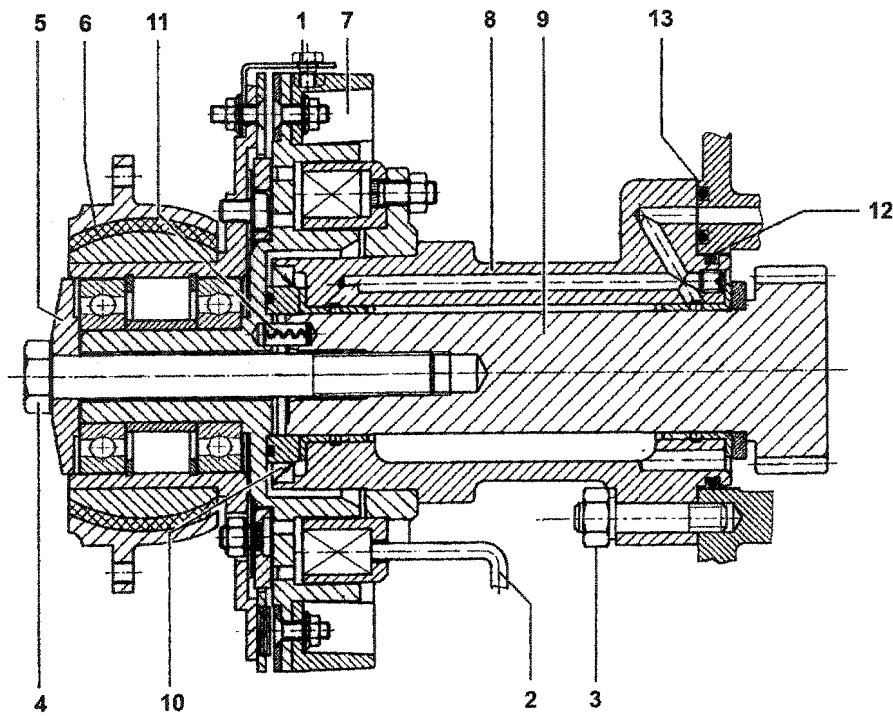
Set the fan coupling 7 with fan hub 6 onto the fan shaft 9, noting the pin 11. Attach the washer 5. Turn in the screw 4 and tighten according to torque specification.

Place new O-rings 12, 13 with grease into the grooves of bearing housing 8 and place into the timing case. Push the fan drive into the timing case, noting the gear mesh. Attach nuts 3 and tighten. Connect the cable 2 to the distributor point.

<b>Tightening torque for screw 4 (2-stage):</b>	Pretorque	Nm 30	Nm 270
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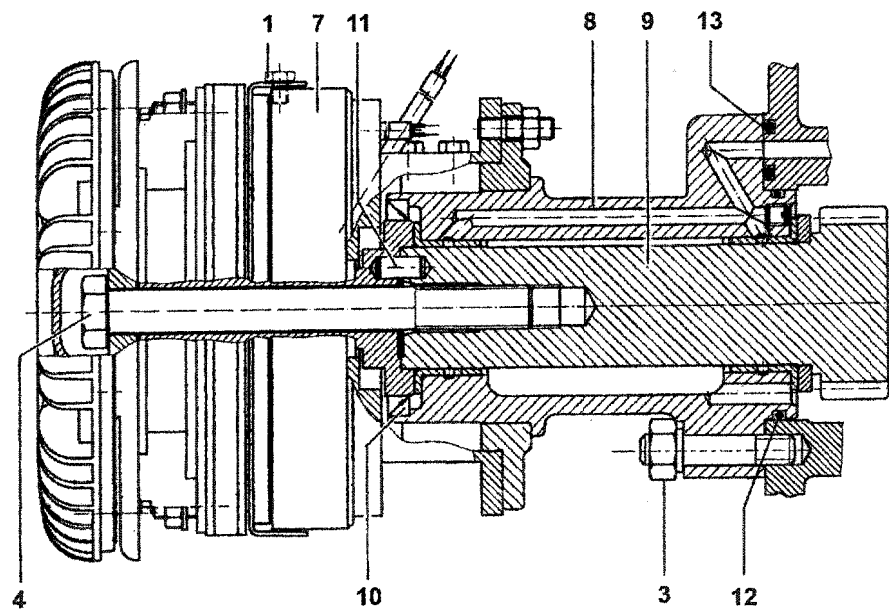
<b>Tightening torque for screw 4 (3-stage):</b>	Nm 180
---	--------

## Fan coupling, 2-stage



910415-1

## Fan coupling, 3-stage



910415-1

- |           |                    |
|-----------|--------------------|
| 1 Screws  | 13 Fan coupling    |
| 2 Cable   | 14 Bearing housing |
| 3 Nuts    | 15 Fan shaft       |
| 4 Screw   | 16 Shaft seal ring |
| 5 Washer  | 17 Pin             |
| 6 Fan hub | 18 O-ring          |
|           | 19 O-Ring          |

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Fan drive

Blatt  
Page 21.3  
Feuille

## 21.4 Fan drive

**Visco coupling, drive with gear, bearing with ball bearing**

**Removal and installation of Visco coupling:**

**Removal:**

Loosen the screws 1 and remove. Remove the Visco coupling 2 with fan 4. Remove nuts 3. Remove the fan 4 from the Visco coupling 2. Install in reverse order.

**Important:**

Place the Visco coupling only vertically (installation position), in horizontal position, there is the danger that oil runs out.

**Removal and disassembly of fan drive:**

Loosen nuts 5 and remove. Remove the fan drive from the timing case. Remove screw 6. Remove fan hub 7 from bearing housing 8 and fan shaft 9. Remove screw 10 and remove it with washer 11. Remove gear 12. Drive the fan shaft 9 with ball bearing 13 from the bearing housing 8 with mandrel. Release the retaining ring 14, push the ball bearing 15 and the shaft seal ring 16 with a mandrel from the bearing housing 8.

**Assembly and installation:**

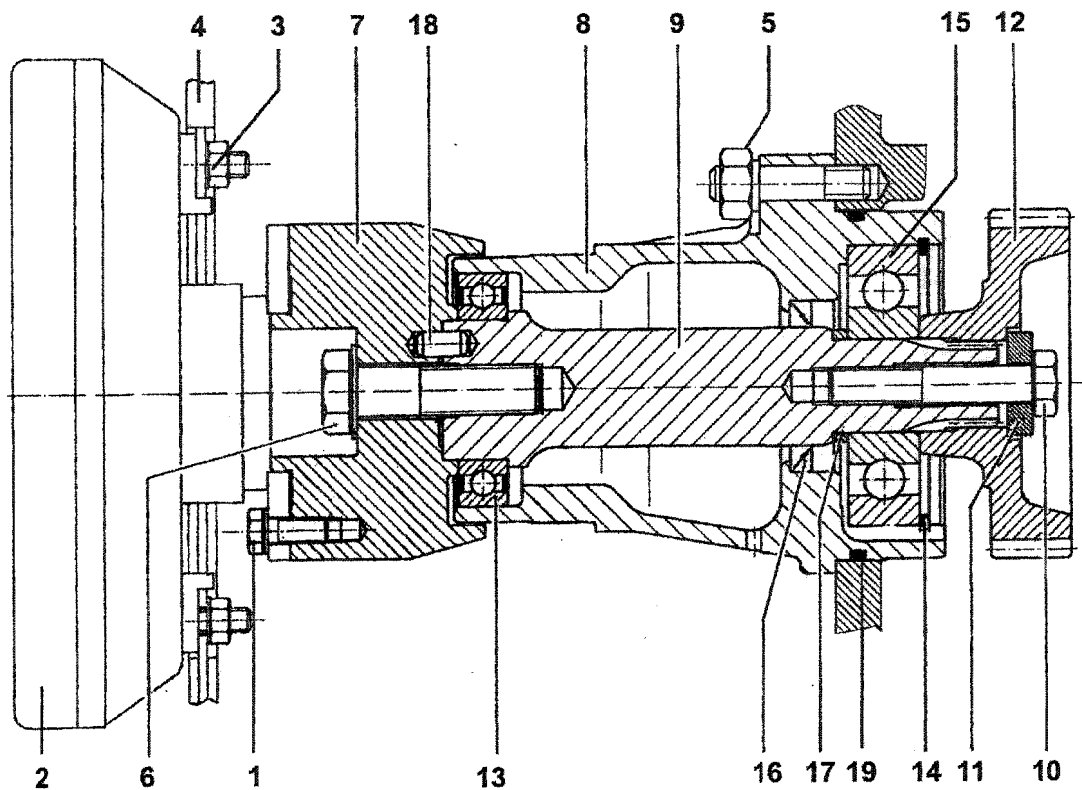
Press a new shaft seal ring 16 into the bearing housing 8. Lightly grease the sealing and protective lip. Push in the ball bearing 15 and insert the retaining ring 14. Set the spacer 17 onto the fan shaft 9 and insert the fan shaft 9 through the shaft seal ring 16 and ball bearing 15 into the bearing housing 8. Set the gear 12 onto the fan shaft, turn in the screw 10 with washer 11 and tighten according to torque specification. Push the ball bearing 13 over the fan shaft 9 into the bearing housing 8. Set the fan hub 7 onto the fan shaft 9, pay attention to the pin 18. Insert the screw 6 and tighten according to torque specification. Install new, lubricated O-ring 19 to the bearing housing 8. Push the fan drive into the timing case. Note the tooth mesh! Attach nuts 5 and tighten.

**Tightening torque for screw 6 :** Pretorque Nm 30                      Nm 270

**Tightening torque for screw 10 :** Pretorque Nm 30                      50  
Nm 120



## Visco- Coupling



910417-1

- |                   |                    |
|-------------------|--------------------|
| 1 Screws          | 11 Washer          |
| 2 Visco coupling  | 12 Gear            |
| 3 Nuts            | 13 Ball bearing    |
| 4 Fan             | 14 Snap ring       |
| 5 Nuts            | 15 Ball bearing    |
| 6 Screw           | 16 Shaft seal ring |
| 7 Fan hub         | 17 Spacer          |
| 8 Bearing housing | 18 Pin             |
| 9 Fan shaft       | 19 O-ring          |
| 10 Screw          |                    |

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Fan drive	Blatt Page Feuille	21.4

## 21.5 Fan drive

**Drive with gear, bearing with bearing bushings**

### **Removal and disassembly:**

Loosen nuts 1 and remove. Remove the fan drive from the timing case. Remove screw 2 and remove the fan hub 3 from the bearing housing 4 or from the fan shaft 5.  
Remove the fan shaft 5 from the bearing housing 4 and take out the shaft seal ring 6.

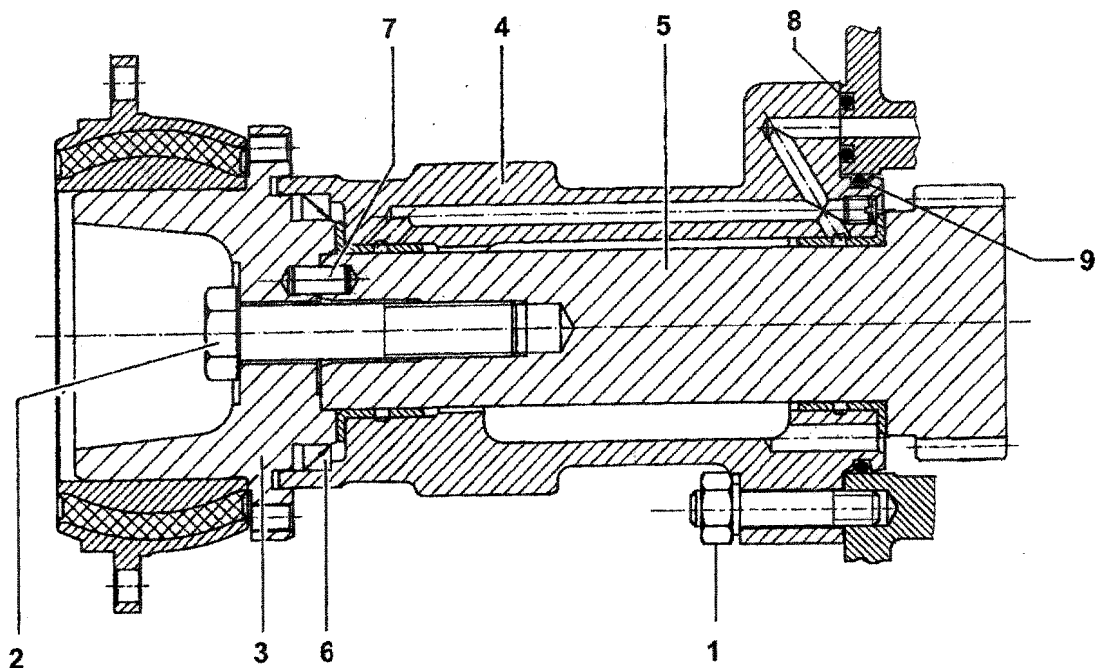
### **Note:**

To disassemble and assemble the fan drive, we recommend to loosen and tighten screw 2 on the fan drive installed on the engine, while holding the ring gear on the flywheel.

### **Assembly and installation:**

Press in new shaft seal ring 6 into the bearing housing 4. Lubricate the sealing and protective lip lightly with grease (Barrierta L 55/3).  
Lubricate the fan shaft 5 and push it into the bearing housing 4.  
Set the fan hub 3 onto the fan shaft 5, noting the pin 7. Turn in the screw 2 and tighten according to torque specification.  
Place new O-rings 8, 9 with grease into the grooves of bearing housing 4 and place into the timing case. Push the fan drive into the timing case, noting the gear mesh. Attach nuts 1 and tighten.

**Tightening torque for screw 2:** Pretorque      Nm 30      Nm 270



910434-1

- 1 Nuts
- 2 Screw
- 3 Fan hub
- 4 Bearing housing
- 5 Fan shaft
- 6 Shaft seal ring
- 7 Pin
- 8 O-ring
- 9 O-ring

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type	D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Fan drive	Blatt Page Feuille	21.5

## 22 Fuel system

### In-line injection pump

The fuel pump 3 draws fuel from the tank 1 through the precleaner 2 and pumps it under pressure via the fuel prefilters 4 and the fuel fine filter 5 to the suction chamber of the injection pump 6.

The fuel is held there at a pressure of approx. 0.5 to 2 bar via the overflow valve. The fuel is pressurized and flows from the injection pump 6 via the injection lines to the fuel injectors 7.

From there it is atomized and sprayed into the combustion chamber.

Excess fuel from the injection pump 6 and from the fuel injectors 7 is returned to the fuel tank 1.

On fuel systems with prefilter 4 with water separator between the fuel tank 1 and the fuel pump 3, the precleaner 2 and the prefilter 4 between fuel pump 3 and injection pump 6 are not installed.

This design protects the fuel pump 3 from wear.

### To bleed the fuel system:

Proceed as follows, in that order:

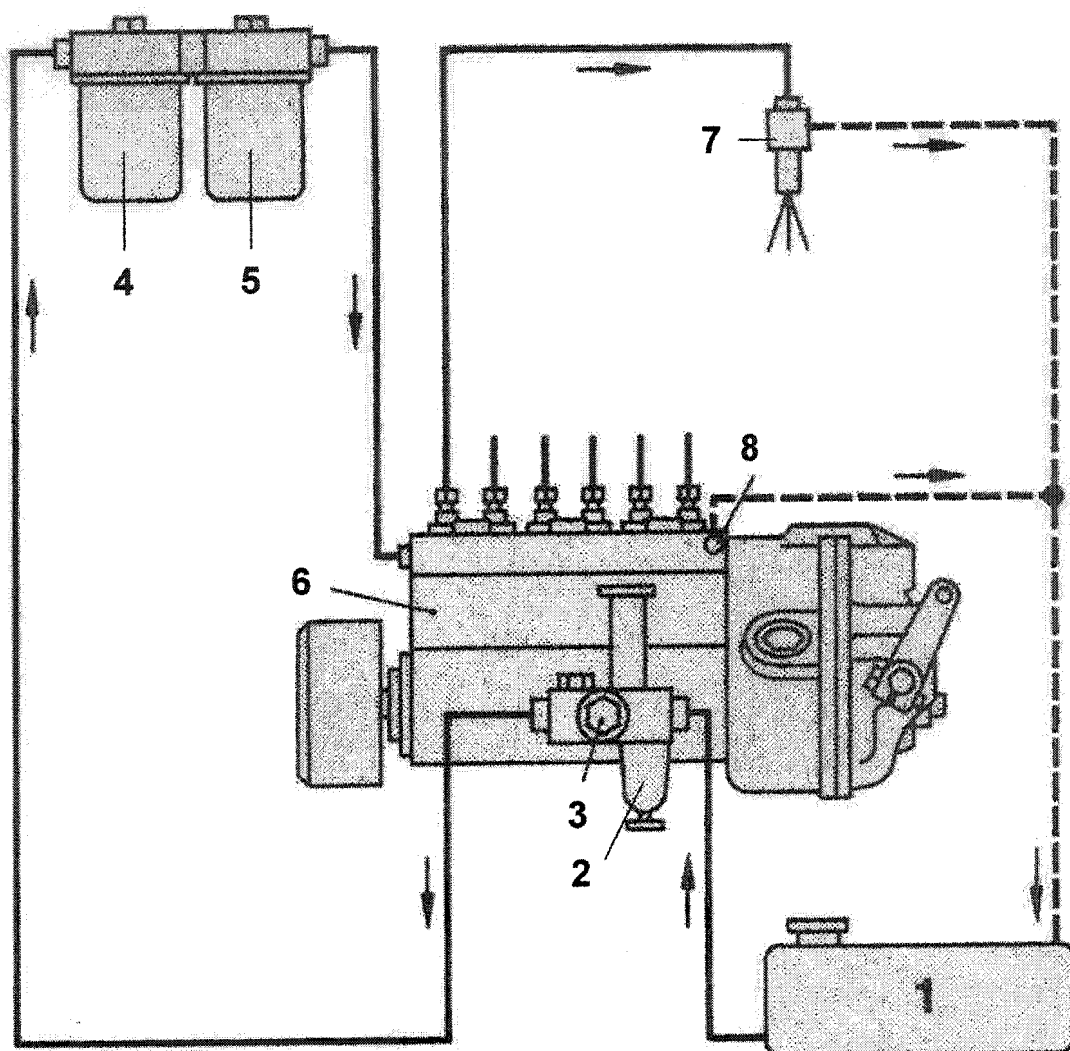
- 1 Loosen the bleeder screw on the fuel prefilter 4.
- 2 Loosen the bleeder screw on the fuel fine filter 5.
- 3 Loosen the fuel line from the fuel fine filter 5 to the injection pump 6 on the injection pump.
- 4 Loosen the overflow valve 8.
- 5 Loosen the union nuts on the injection lines on the fuel injectors 7.

From point 1 to 4, actuate the hand pump on the fuel pump 3 until fuel emerges without air bubbles. Retighten the screws.

At point 5, actuate the starter until fuel emerges without air bubbles. Retighten the lines.

### Note:

If there is a prefilter 4 between the fuel tank 1 and the fuel pump 3, the bleeder screw on the fuel filter does not have to be opened.



1. Fuel tank
2. Pre-cleaner
3. Fuel pump
4. Fuel pre-filter
5. Fuel fine filter
6. Injection pump
7. Fuel injector nozzle
8. Overflow valve

——— Pressurized

----- No pressure

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ      D 904 / 914 / 924 Model Type     D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Fuel system	Blatt Page Feuille                      22

## 22.1 Fuel system

### Distributor injection pump

The fuel pump 3 draws fuel from tank 1 through the fuel prefilter 2 and pumps it under pressure via the fuel fine filter 4 to the injection pump 5.

The fuel flows under pressure from the injection pump 5 via the injection lines to the fuel injectors 6.

From there it is atomized and sprayed into the combustion chamber.

The excess fuel from the injection pump 5 and from the fuel injectors 6 is returned to the fuel tank 1.

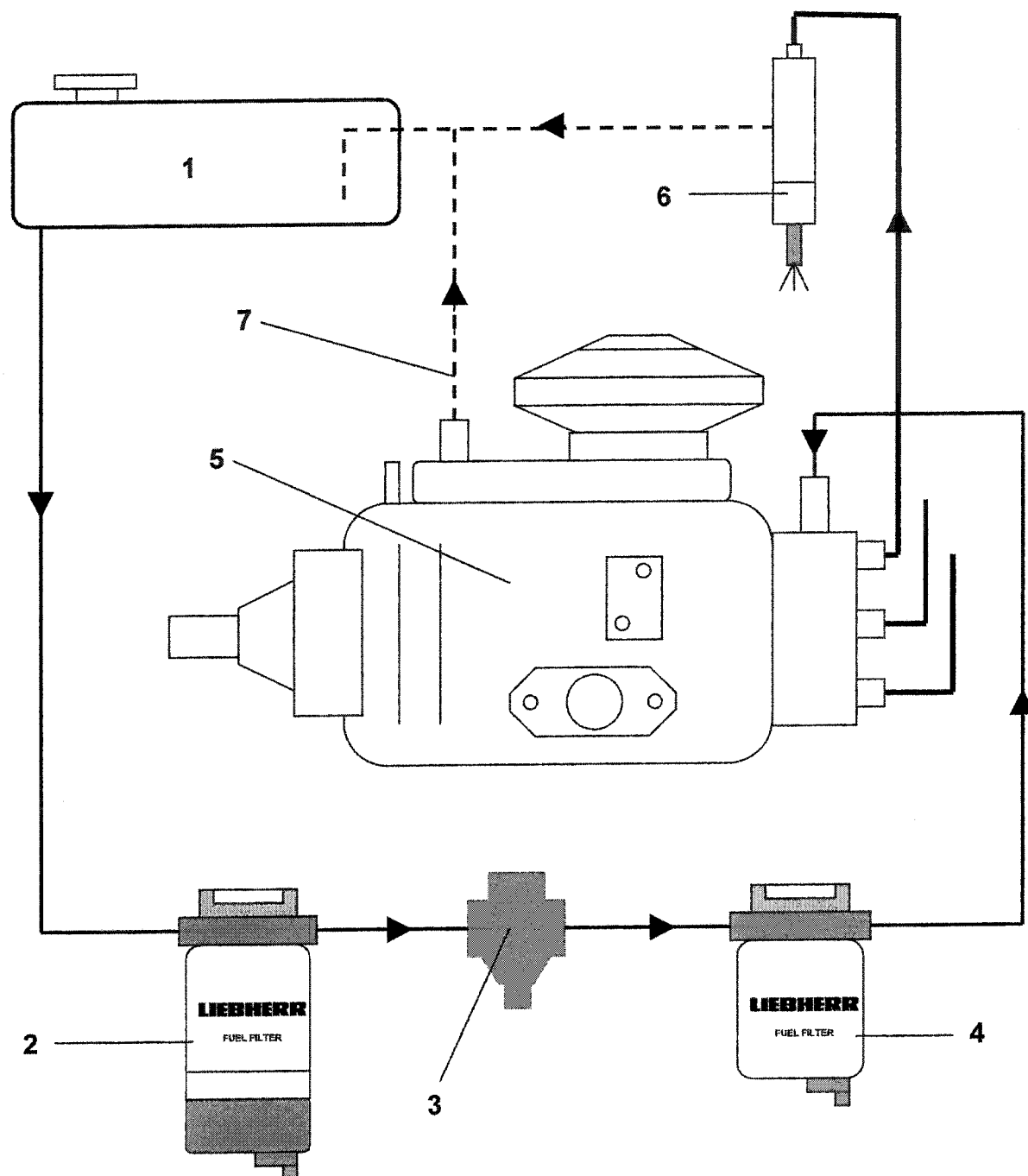
### To bleed the fuel system:

Proceed as follows, in that order:

- 1 Loosen the bleeder screw on the fuel fine filter 4.
- 2 Loosen the fuel line 7 from the injection pump 5 to the fuel tank 1 on the injection pump.
- 3 Loosen the union nuts on the injection lines on the fuel injector valves 6.

At point 1, 2, actuate the lever on the fuel pump 3 until fuel emerges without air bubbles. Retighten the screws.

At point 3, actuate the starter until fuel emerges without air bubbles. Retighten the lines.



- 1 Fuel tank
- 2 Fuel pre-filter
- 3 Fuel pump
- 4 Fuel fine filter
- 5 Injection pump
- 6 Injector nozzle
- 7 Fuel return line

—— Pressurized  
 - - - - No pressure

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ      D 904 / 914 / 924 Model    D 906 / 916 / 926 Type
Datum / Edition / Date 12 / 2003	Fuel system	Blatt Page Feuille 22.1

## 23 Fuel pump

### Installation on in-line injection pumps

On engines with in-line injection pumps, a simple fuel pump made by Bosch is installed. Depending on the engine model, it is actuated via a single cam or double cam on the camshaft of the injection pump.

On the version with the single cam, one stroke is actuated per rotation, 2 strokes on the double cam.

### Function :

During the cam stroke, the pump piston 13 with the integrated suction valve 2 is moved by the glide plunger 9 against the force of the spring 7.

The suction valve 2 is opened due to the vacuum, which is created in the working chamber, and fuel flows through the vents in the piston bottom into the working chamber between the suction valve 2 and the pressure valve 6.

At the return stroke due to the spring 7, the suction valve 2 closes, the pressure valve 6 is opened and fuel is supplied into the pressure line and on via the filters to the injection pump.

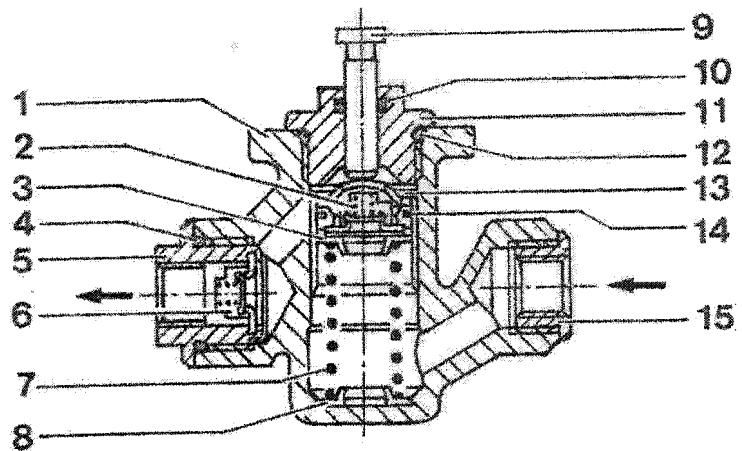
### Note:

If the O-ring 10 on the fuel pump leaks, Diesel fuel will get into the engine oil via the injection pump!



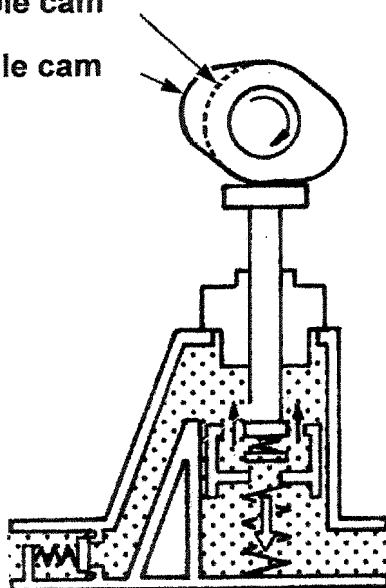
## Design

- 1 Pump housing
- 2 Suction valve
- 3 Spring plate
- 4 O-ring
- 5 Pressure connection
- 6 Pressure valve
- 7 Pressure spring
- 8 Spring plate
- 9 Plunger
- 10 O-ring
- 11 Plunger housing
- 12 O-ring
- 13 Pump piston
- 14 Spacer
- 15 Suction connection

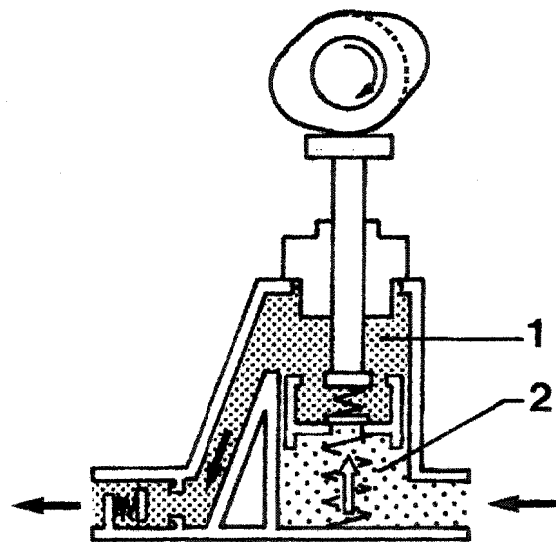


- 1 Working chamber
- 2 Suction chamber

double cam  
Single cam



Cam stroke



Spring stroke

Blatt 23-1

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Fuel pump	Blatt Page Feuille 23

## 23.1 Fuel pump

### Installation on distributor injection pumps

On engines with distributor injection pumps, a membrane fuel pump made by Pierburg is installed.

On this version, a cam on the drive gear of the injection pump is actuated, via a drive lever 1. One stroke is actuated per rotation.

### Function :

During the cam stroke, the drive lever 1 pushes the membrane rod 2 with its fork-like end and thereby the membrane 3 against the spring force downward. This is the suction stroke of the fuel pump.

Due to the opening inlet valve 4, the fuel is drawn into the membrane chamber. The outlet valve 6 remains closed. If the drive lever 1 then runs off the cam, the membrane 3 is moved during its upward stroke only by the force of the spring 5. During this stroke, the fuel is supplied through the opening outlet valve 6 to the injection pump. The inlet valve 4 remains closed.

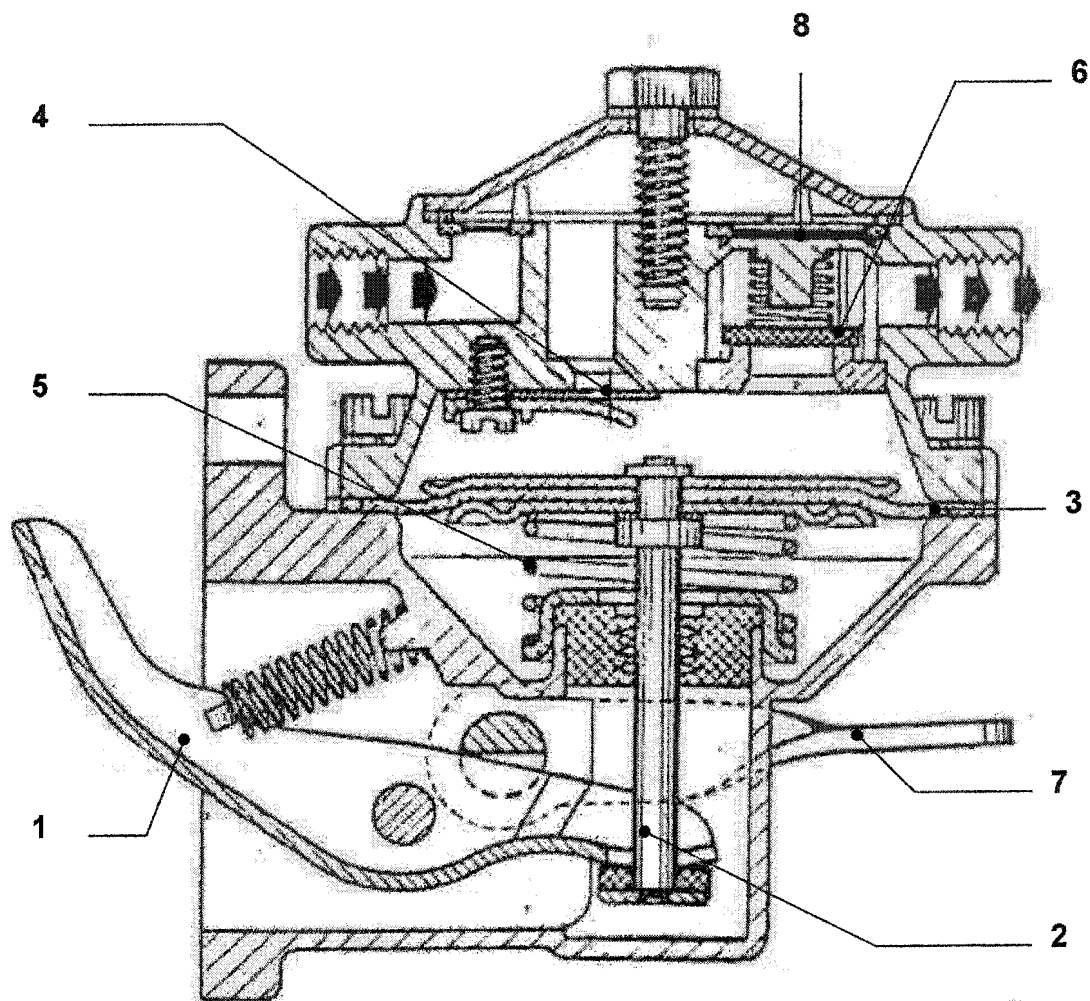
The spring force of spring 5 is designed in such a way that the membrane 3 moves only part of the stroke if pressure increases in the supply line, and stops altogether when the maximum static pressure is reached.

This protects pump and drive parts from damage due to high pressure.

The hand pump device consists of an external manual lever 7, which moves the drive lever 1 when actuated.

### Note:

If membrane 3 on the fuel pump leaks, Diesel fuel will get into the engine oil via the injection pump drive!



1. Drive lever
2. Membrane rod
3. Membrane
4. Inlet valve
5. Spring
6. Outlet valve
7. Hand lever
8. Fuel strainer

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 924 / 926 T-E
Datum / Edition / Date 12 / 2003	Fuel pump	Blatt Page Feuille 23.1

## 24 Fuel filter

### Installation on engines with in-line injection pumps

On earlier engine models, the fuel filter was installed as a fuel stage box filter between the fuel pump and the injection pump.

The prefilter 1 had a filter sensitivity of 50 - 60  $\mu\text{m}$ , the fine filter 2 of 7 - 8  $\mu\text{m}$ .

Drain plugs (see arrows) are installed on the underside of the filter.

On newer engine models, the prefilter 3 is installed between the fuel tank and the fuel pump and the fine filter 4 between fuel pump and injection pump.

This design protects the fuel pump from wear.

The prefilter 3 has a filter sensitivity of 30  $\mu\text{m}$ , the fine filter 4 of 7 - 8  $\mu\text{m}$ .

Drain plugs (see arrows) are installed on the underside of the filter.

For maintenance intervals to drain condensation, refer to the Maintenance Schedule.

### To change the fuel filter:

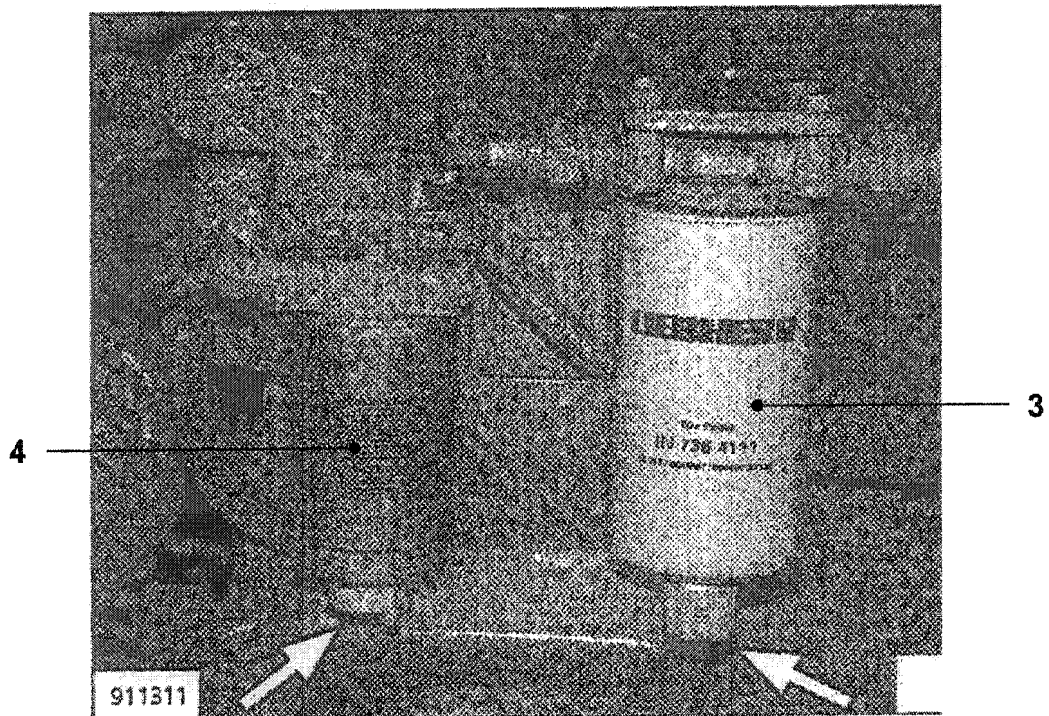
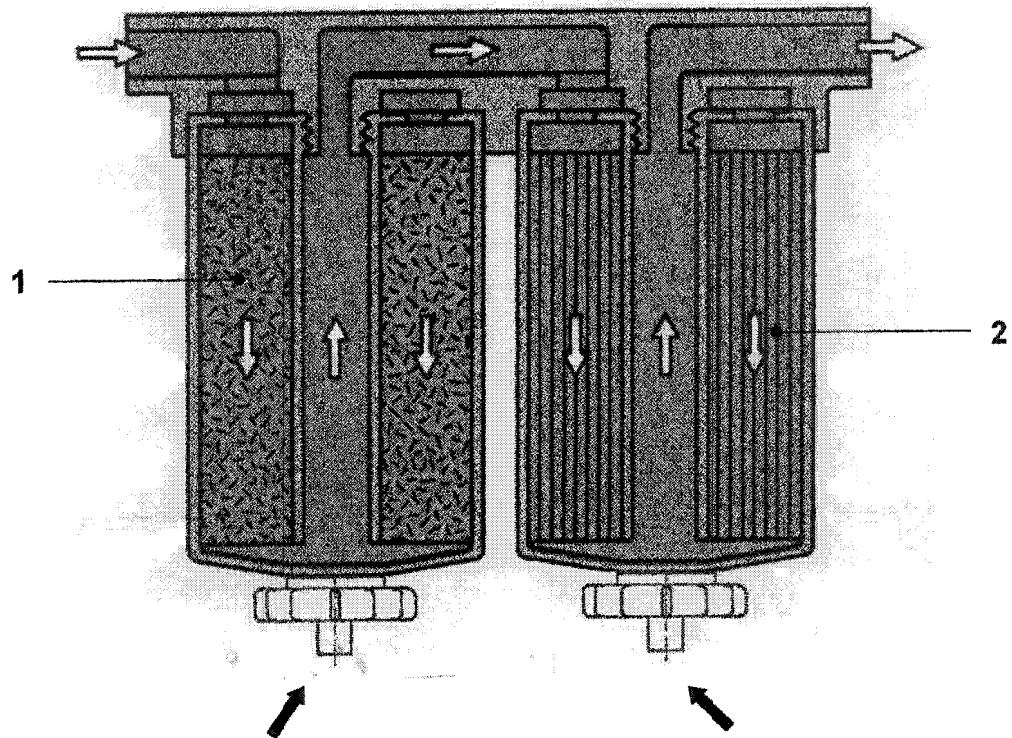
For change intervals, see Maintenance Schedule.

1,3 = Prefilter      2,4 = Fine filter

Remove the filter elements and clean the sealing surface on the filter console .

Install new filter elements, lubricate the rubber seal ring lightly with oil, and tighten by hand. To bleed the fuel system, see page 22.

## Stage box filter



**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Fuel filter

Blatt  
Page  
Feuille  
24

## 24.1 Fuel filter

### Installation on engines with distributor injection pumps

On engines with distributor injection pumps, a pre- and two fine filter is installed to filter the fuel.

The prefilter 1 is installed between the fuel tank and the fine filters 2 is installed between the fuel pump and the injection pump.

The prefilter 1 has a filter sensitivity of 30  $\mu\text{m}$ , the fine filter 2 of 2  $\mu\text{m}$ .

The two fine filters are arranged parallel.

The prefilter 1 has a water separator with drain plug (see arrow). The fine filters 2 has a drain plug (see arrow).

For maintenance intervals, see Maintenance Schedule.

### To change the fuel filter:

For change intervals, see Maintenance Schedule.

#### Prefilter:

Remove screws, cover 5 and the filter. Insert new filter and install cover 5 with new gasket.

#### Fine filter:

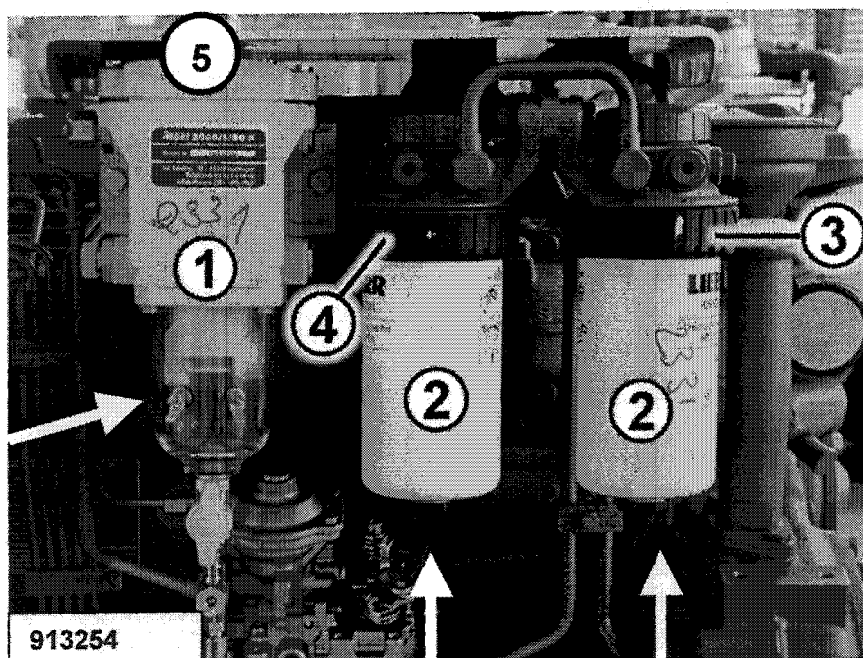
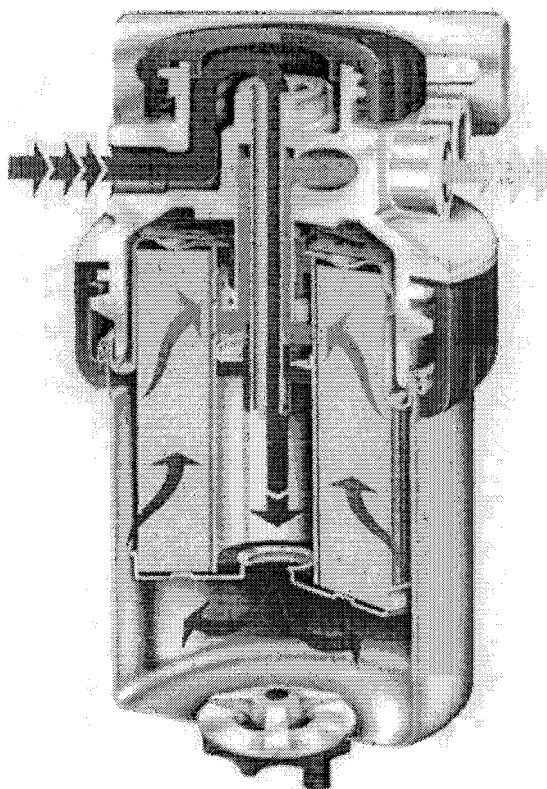
Turn the mounting rings 3, 4 to the left and remove the filter elements 2 from the filter console.

Push the mounting rings 3, 4 over the new filter element 2.

Install new filter elements 2 on the filter console and turn the mounting rings 3, 4 to the stop.

To bleed the fuel system, see page 22.1.

## Flow schematic



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Fuel filter

Typ Model Type  
D 924 / 926 T-E A1

Blatt  
Page  
Feuille

24.1

## 25 Injection pumps

On D 904 / 906 engines, in-line injection pumps made by Bosch, pump size „A“ , are installed.

Engine	RPM <sup>1</sup> /min	Injection pump size	Pump piston diameter Ø mm	Injection pump regulator, LDA-installation
D 904 NA	2000	A	9,5	RSV
D 904 TB	2000	A	9,5	RSV
D 904 T	2000	A	10	RQV / LDA
D 904 T	2000 / 2100	A	9,5	RSV / LDA
D 906 NA	2000	A	9,5	RSV
D 906 TB	2000	A	9,5	RSV
D 906 T	2000	A	10	RQV / LDA
D 906 T	2000	A	9,5	RSV
D 906 TI	2000	A	10	RQV / LDA

### Removal:

#### Installation on injection pump drive, page 26

For positioning, see page 26.

Remove RPM control, shut off device, electrical lines, air lines to suction pipe (LDA installation), fuel lines, injection lines and lube oil line. Remove the mounting screws on the injection pump. Pull the injection pump from the injection pump drive.

If the coupling sleeve 2 also pulls out, then push it again onto the drive hub 3.

### Installation:

Install new O-ring 4 and lubricate it lightly with oil. Push the injection pump with gear shaft 1 into the coupling sleeve 2 in such a way that the tension pin 5 in the gear shaft 1 and the bore 6 in hub 3 align. Push the injection pump into the injection pump drive. Install the mounting screws and tighten.

Install all parts, which were removed before.

### Removal:

#### Installation on injection pump drive, page 26.1

For positioning, see page 26.1

Remove RPM control, shut off device, electrical lines, air lines to suction pipe (LDA installation), fuel lines, injection lines and lube oil line. Remove the mounting screws on the injection pump. Pull the injection pump from the injection pump drive.

### Installation:

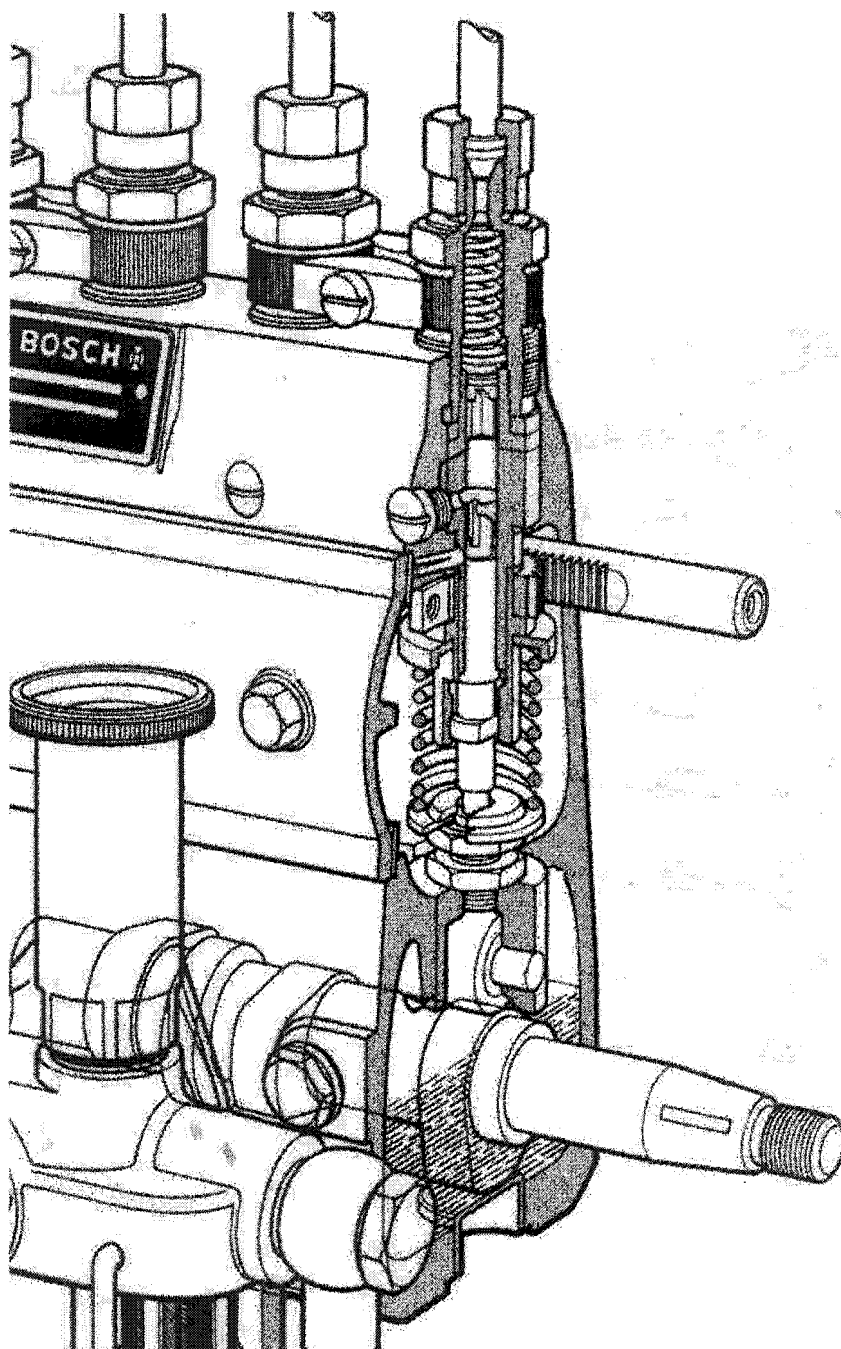
Install new O-ring 1 and lubricate it lightly with oil. Push the injection pump with gear shaft 2 into the hub 3 that the recess on the gear shaft 2 (missing tooth) and the gap in drive hub 3, which is closed off with tension pin 4 align. Push the injection pump into the injection pump drive. Install the mounting screws and tighten.

Install all parts, which were removed before.

Set begin of delivery, see page 26, 26.1.

Add about 1 liter of engine oil to the regulator housing before using the new injection pump.





**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Injection pump  
Pump size >A<

Typ  
Model  
Type

D 904 / 906

Blatt  
Page  
Feuille

25

## 25.1 Injection pumps

On engine models D 914 / 916 / 924 / 926, in-line injection pumps made by Bosch, pump size „MW“ are installed.

Engine models D 924 / 926 are also made with other injection pump sizes.

Engine	RPM <sup>1</sup> /min	Injection pump size	Pump piston diameter Ø mm	Injection pump regulator, LDA installation
D 914 T	1800 / 2000	MW	10	RSV / LDA
D 914 TI	1800 / 2000	MW	10	RSV / LDA
D 924 T-EA2	1500 / 1800 / 2000	MW	10	RSV / LDA
D 924 TI-EA2	1800 / 2000	MW	10	RSV / LDA
D 916 T	1800 / 2000 / 2100	MW	10	RSV / LDA
D 916 TI	1800 / 2000 / 2100	MW	10	RSV / LDA
D 926 T-EA2	1800 / 2000	MW	10	RSV / LDA

### Removal:

#### Installation on injection pump drive, page 26

For positioning, see page 26.

Remove RPM control, shut off device, electrical lines, air lines to suction pipe (LDA installation), fuel lines, injection lines and lube oil line. Remove the mounting screws on the injection pump. Pull the injection pump from the injection pump drive.

If the coupling sleeve 2 also pulls out, then push it again onto the drive hub 3.

### Note:

On 6 cylinder engines, the support from injection pump to crankcase must also be removed.

### Installation:

Install new O-ring 4 and lubricate it lightly with oil. Push the injection pump with gear shaft 1 into the coupling sleeve 2 in such a way that the tension pin 5 in the gear shaft 1 and the bore 6 in hub 3 align. Push the injection pump into the injection pump drive. Install the mounting screws and tighten.

Install all parts, which were removed before.

### Removal:

#### Installation on injection pump drive, page 26.1

For positioning, see page 26.1

Remove RPM control, shut off device, electrical lines, air lines to suction pipe (LDA installation), fuel lines, injection lines and lube oil line. Remove the mounting screws on the injection pump. Pull the injection pump from the injection pump drive.

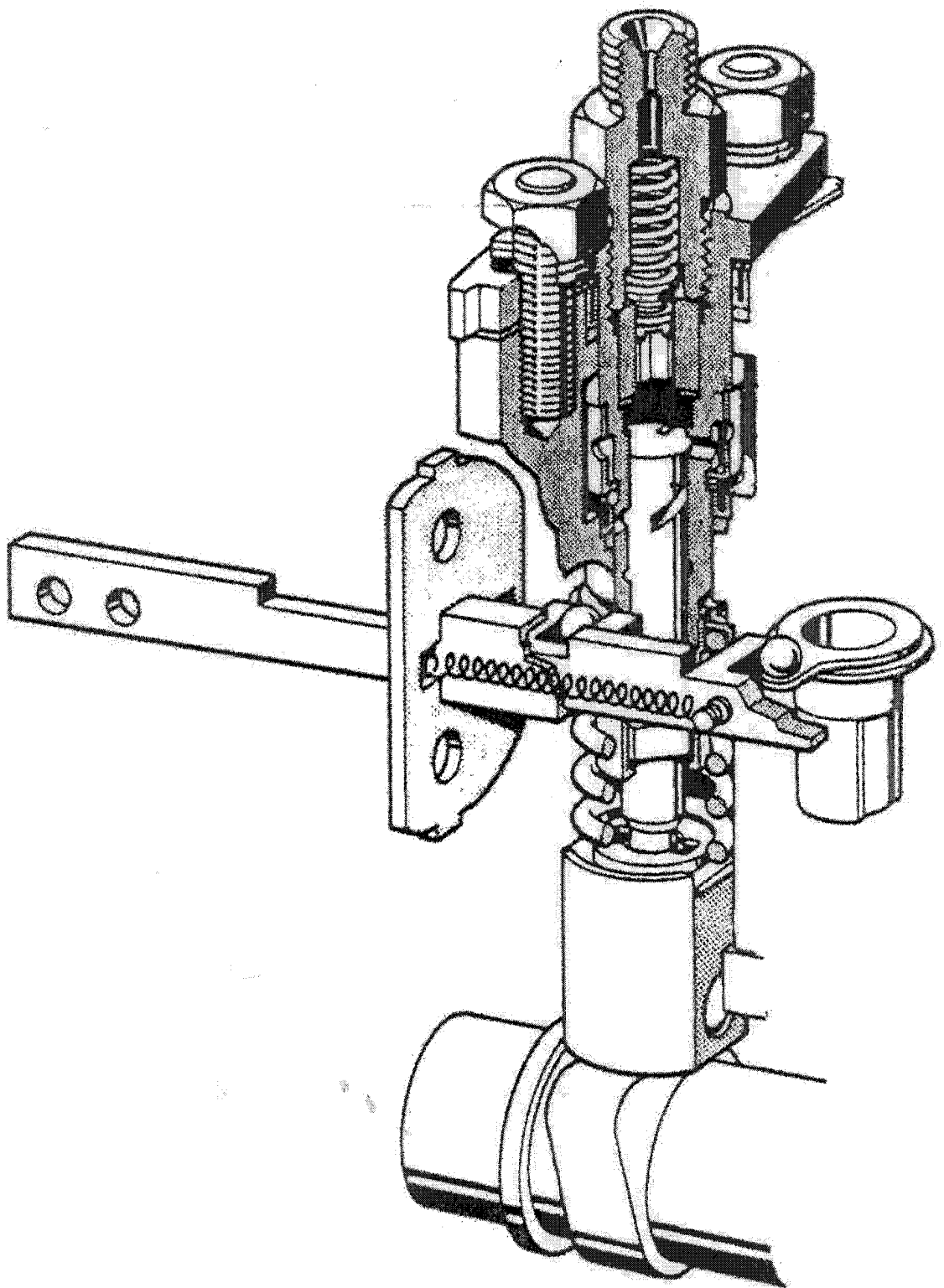
### Note:

On 6 cylinder engines, the support from injection pump to crankcase must also be removed. .

**Installation:**

Install and lubricate new O-ring 1. Guide the injection pump with gear shaft 2 into the drive hub 3 that the recess on the gear shaft 2 (missing tooth) aligns with the tooth gap, which is closed with the tension pin 4 in the drive hub 3. Push the injection pump into the injection pump drive. Insert the mounting screws and tighten. Install all removed parts.  
Adjust begin of delivery, see page 26, 26.1.  
Before using the new injection pump, add approx. 1 liter engine oil to the regulator housing.

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 914 / 924
		Model Type	D 916 / 926
Datum / Edition / Date 12 / 2003	Injection pump	Blatt Page Feuille	25.1



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Injection pump  
Pump size >MW<

Typ  
Model  
Type  
D 914 / 924  
D 916 / 926

Blatt  
Page  
Feuille  
25.1

## 25.2 Injection pumps

On engine models D 924 / 926, in-line injection pumps made by Bosch, pump size „P“ are installed.

Depending on the engine version, injection pumps, size P 3000 or P 7100 are also used.

Engine models D 924 / 926 are also made with other injection pumps.

Engine	RPM <sup>1</sup> /min	Injection pump size	Pump piston diameter Ø mm	Injection pump regulator, LDA installation
D 924 TI-EA2	1800 / 2000	P 3000	Ø 11	RSV / LDA
D 924 TI-EA4	1800 / 1900 / 2000	P 7100	Ø 12	EDC
D 926 TI	1800 / 2000	P 3000	Ø 11	RSV / LDA
D 926 TI	2100	P 7100	Ø 12	RQV-K / LDA
D 926 TI-EA2	1800 / 2000	P 3000	Ø 11	RSV / LDA
D 926 TI-EA3	1800 / 2100	P 7100	Ø 11	RQV-K / LDA
D 926 TI-EA4	1800	P 7100	Ø 11	EDC
D 926 TI-EA4	1900	P 7100	Ø 12	EDC

### Removal:

#### Installation on injection pump drive, page 26.1

For positioning, see page 26.1.

Remove RPM control, shut off device, electrical lines, air lines to suction pipe (LDA installation), fuel lines, injection lines and lube oil line. On A4 engines with EDC regulator, remove the mounting screw for the electric plug on the EDC regulator and pull the plug from the regulator. The injection pump must be without power, turn the ignition off.

Remove the mounting screws on the injection pump.

Pull the injection pump from the injection pump drive.

### Note

On 6 cylinder engines, the support from injection pump to crankcase must also be removed.

### Installation:

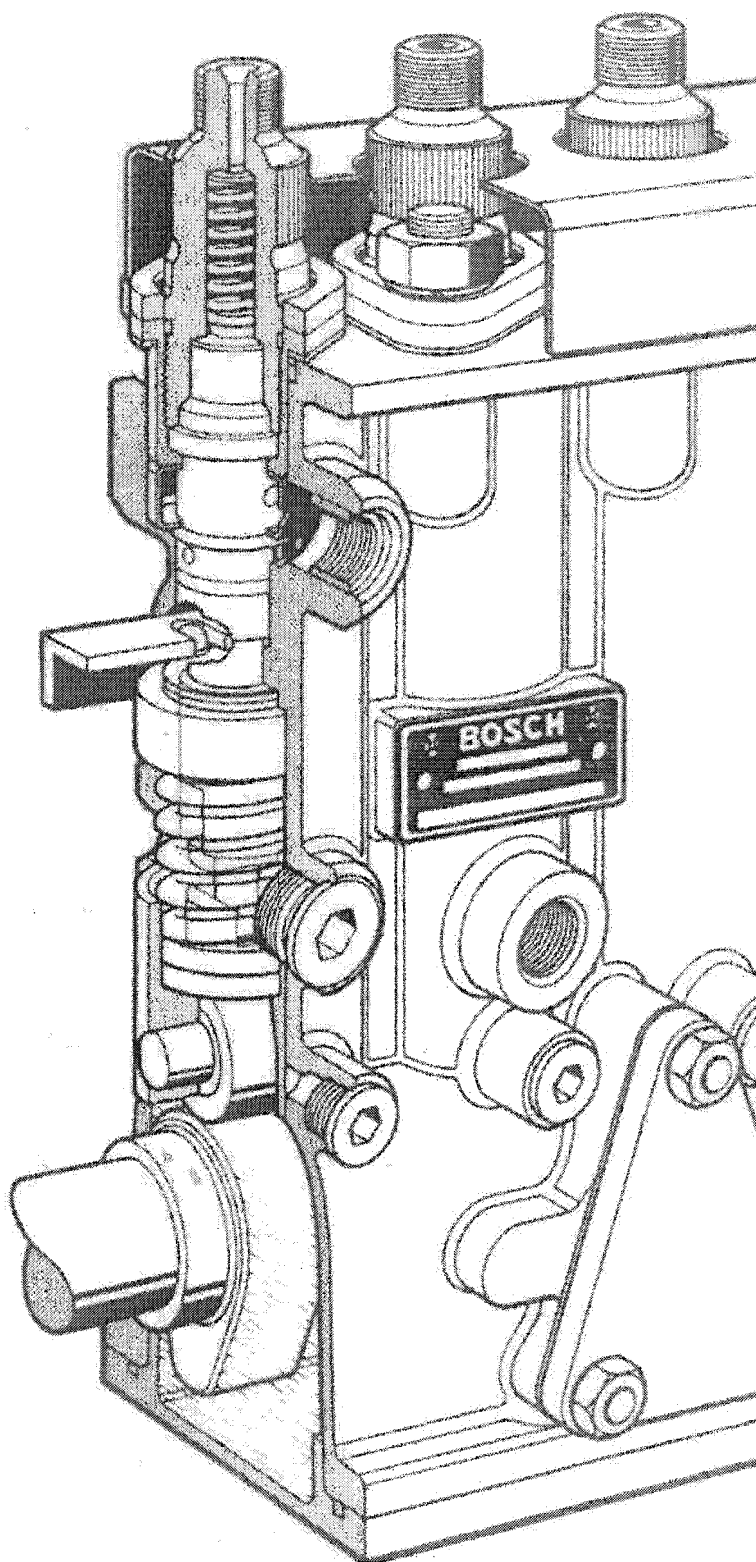
Install new O-ring 1 and lubricate it lightly with oil. For lube oil supply on drive side of the injection pump, place a new O-ring with grease into the groove on the injection pump. Push the injection pump with gear shaft 2 into the drive hub 3 in such a way that the recess on the gear shaft 2 (missing tooth) and the gap in drive hub 3, which is closed off with tension pin 4, align. Install mounting screws and tighten.

Install all parts, which were removed before.

Set begin of delivery, see page 26.1

Add about 1 liter of engine oil on into the regulator housing before using the new injection pump.

On A4 engines with EDC regulator, add approx. 0,1 liter and approx. 0.4 l of engine oil into the injection pump.



<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type         D 924 / 926
Datum / Edition / Date 12 / 2003	Injection pump Pump size >P<	Blatt Page Feuille         25.2

## 25.3 Injection pumps

On engine models D 924 / 926 T-E A1, distributor injection pumps (VE) made by Bosch are installed.

Engine	RPM <sup>1</sup> /min	Injection pump	LDA installation
D 924 T- EA 1	2000	VE	
D 924 T- EA 1	2000	VE	LDA
D 926 T- EA 1	2000	VE	LDA

### Removal:

#### Installation on injection pump drive, page 26.2

For positioning, see page 26.2

Remove the fuel pump, RPM control, electrical lines, air lines to suction pipe (LDA installation), fuel lines and injection lines. Remove the mounting screws on the injection pump. Pull the injection pump from the injection pump drive.

### Installation:

Install new O-ring 1 and lubricate it lightly with oil. Push the injection pump with gear shaft 2 into the drive hub 3 in such a way that the tension pin 4 in the gear shaft 2 and the bore 5 in drive hub 3 align.

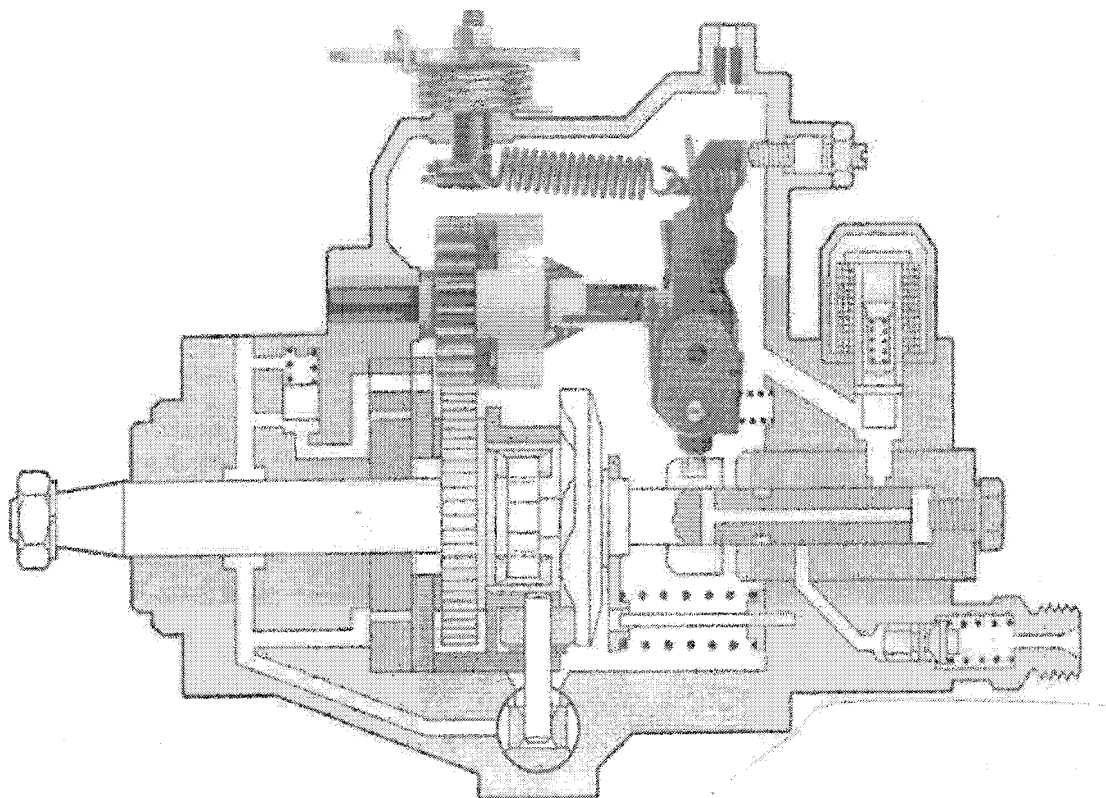
Push the injection pump into the injection pump drive.

Install the mounting screws and tighten.

Install all parts, which were removed before.

Set begin of delivery, see page 26.2.

Before using the new injection pump, add about 1/4 liter of fuel on the connection of fuel line and fine filter.



<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type
Datum / Edition / Date 12 / 2003	Injection pump Pump size >VE<	D 924 / 926 T-E A1  Blatt Page Feuille



## 25.4 Injections pumps

On engine models D 924 / 926 TI-E A5 in – line injection pumps made by Bosch, Control – sleeve injection pump ( H-RP43) are installed.

Engine	RPM <sup>1</sup> / min	Injection pump size	Pump piston diameter Ø mm	Injection pump regulator
D 924 TI-E A5	1800 / 1900 2000 / 2100	H-RP43	12	EDC
D 926 TI-E A5	1800 / 1900 2000 / 2100	H-RP43	12	EDC

### Removal:

#### Installation on injection pump drive, page 26.3

for positioning, see page 26.3

Remove fuel lines and injection lines .

Disconnect the electrical plug connection between the cable from the injection pump regulator (EDC) and the cable from the engine control unit.

The injection pump may not be energized. Turn the ignition off on the machine.

Remove the mounting screws on the injection pump. Pull the injection pump from the injection pump drive.

### Note:

On 6 cylinder engines, the support from injection pump to crankcase must also be removed.

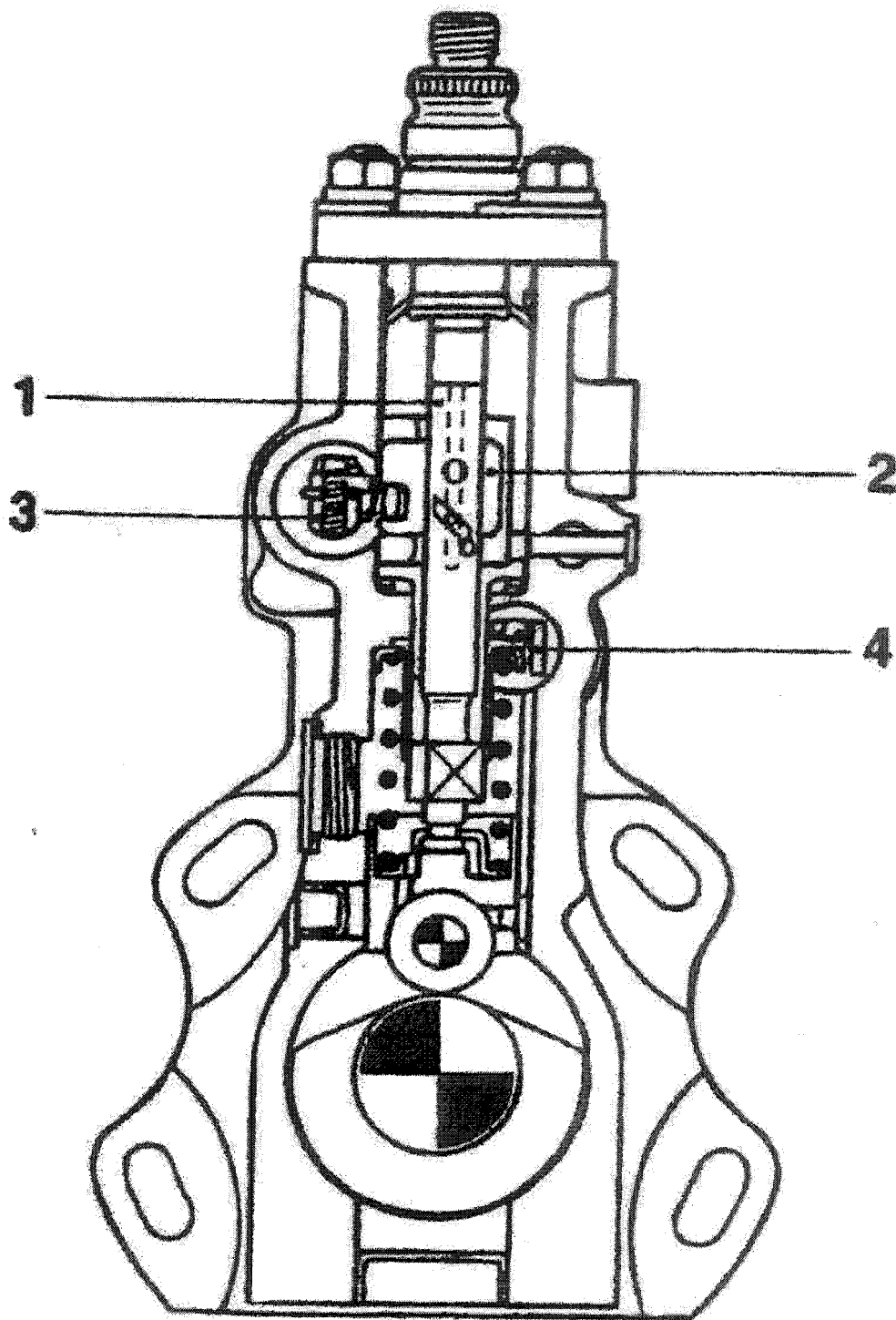
### Installation:

Install new O-ring 1 and lubricate it lightly with oil. For lube oil supply on drive side of the injection pump, place a new O-ring with grease into the groove on the injection pump. Push the injection pump with gear shaft 2 into the drive hub 3 in such a way that the recess on the gear shaft 2 ( missing tooth) and the gap on drive hub 3, which is closed off with tension pin 4, align. Install mounting screws and tighten.

Install all parts, which were removed before.

Set begin of delivery, see page 26.3.

Before operating a new injection pump, add approx. 0,1 liter engine oil into EDC regulator and approx. 0,6 liter into the injection pump.



- 1 Pump piston
- 2 Control-sleeve
- 3 Control-sleeve, shaft
- 4 Regulating rod

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ      D 924 / 926 TI-E A5 Model Type
Datum / Edition / Date 12 / 2003	Injection pump H-RP43 (control-sleeve injection pump)	Blatt Page      25.4 Feuille

## 26 Injection pump drive, adjust begin of delivery

### Drive installed on timing case

On this drive, in-line injection pumps of pump size „A“ and „MW“ are installed.  
The connection of injection pump to drive is made via gear shaft 1 and coupling sleeve 2.

### Set begin of delivery (FB):

For begin of delivery data, see Engine Data.  
Remove screws 7 and push cover 8 from the timing case.  
Set cylinder 1 to the exact FB mark.

### Note:

The center of the two threaded holes on the inspection port / flywheel housing are the reference points.  
The flywheel is marked with the OT (upper dead center ) and the 10° to 30° marks.

Install a high pressure hand pump or overflow pipe on cylinder 1 of the injection pump. Turn off the starting boost. Release screws 9, turn the drive hub 3 with a commercially available pin spanner approx. 90° to the left (turning direction as seen from the fan side onto the engine). Actuate the hand pump, turn back the drive hub 3 to the right until flows from the overflow pipe in droplets. The FB is set. Tighten screws 9 and check the FB (begin of delivery) again by turning the engine.  
If adjustment is correct, reinstall everything.

### Turn off the starting boost:

#### Injection pump „A“ with RQV regulator:

Remove the protective cap and push the regulating rod back until the lock engages.

#### Injection pump „A“ with RSV regulator:

Remove the protective cap and position the regulating rod in such a way, that it emerges about 10 to 12 mm from the end of the thread of the protective cap.

#### Injection pump „MW“ with RSV regulator:

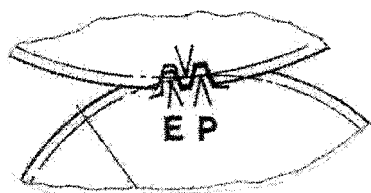
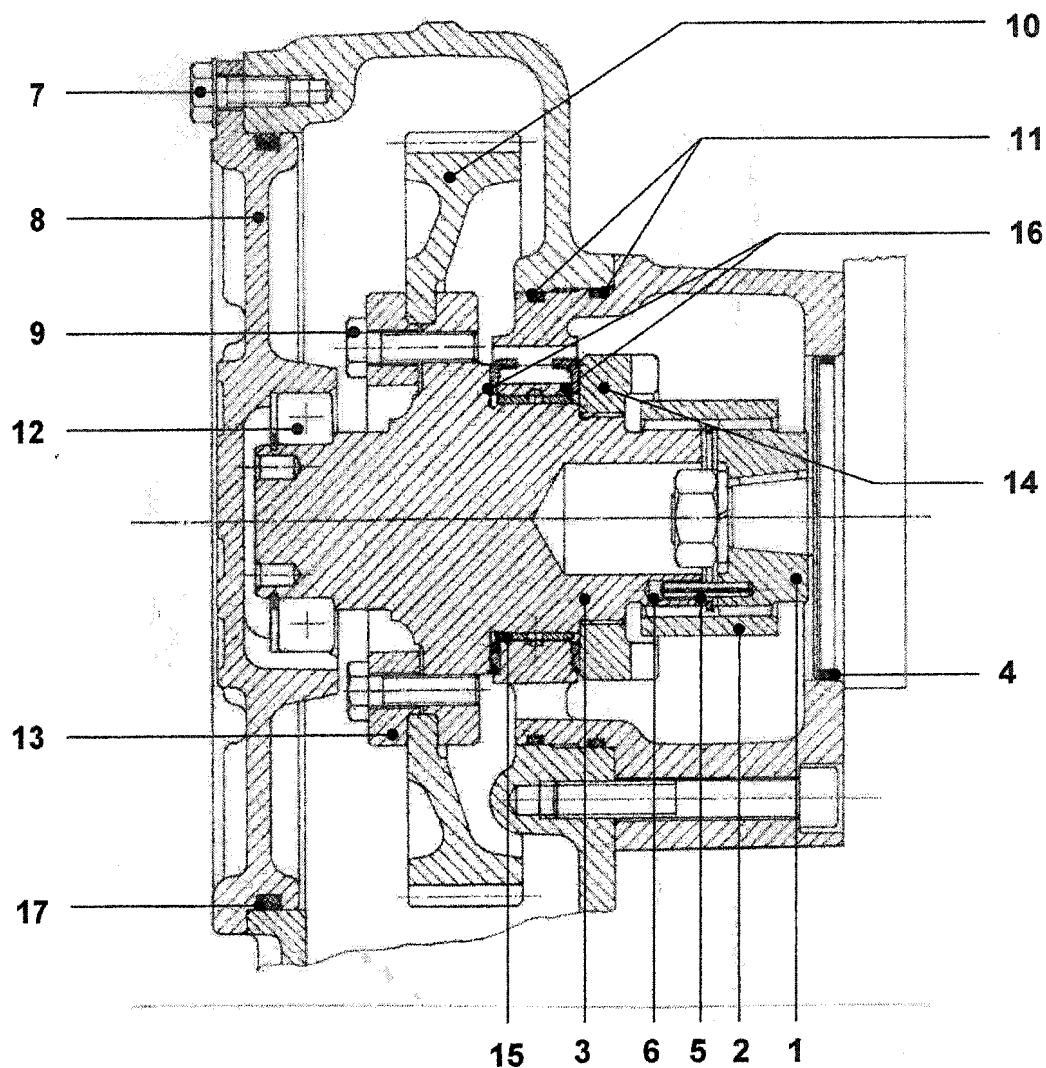
Set the shut off lever to shut off. Attach the retaining device, Id. No. 0527462 to the shut off lever and move the shut off lever back to the stop of the retaining device to the injection pump.  
Set the control lever to full load.

#### Injection pump „MW“ with RSV regulator and solenoid for release of starting boost:

The solenoid may not be actuated with electrical current. Bring the shut off lever from shut off position to normal position.  
Set the control lever to full load.

### Note:

The injection pump and regulator descriptions are noted on the data tag of the injection pump or regulator.



- |                   |                  |                   |
|-------------------|------------------|-------------------|
| 1 Gear shaft      | 8 Cover          | 15 Bearing sleeve |
| 2 Coupling sleeve | 9 Screws         | 16 Thrust washer  |
| 3 Drive hub       | 10 Gear          | 17 O- ring        |
| 4 O- ring         | 11 O- rings      |                   |
| 5 Tension pin     | 12 Ball bearing  |                   |
| 6 Bore            | 13 Lock ring     |                   |
| 7 Screws          | 14 Threaded ring |                   |

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Injection pump drive  
Adjust begin of delivery

Typ  
Model  
Type  
D 904 / 914  
D 906 / 916

Blatt  
Page  
Feuille  
26

## 26.1 Injection pump drive, adjust begin of delivery

### Drive is integrated in timing case

In-line injection pumps, size „A“, „MW“ and „P“ are installed on this drive.  
The injection pump is connected to the drive via the gear shaft 2 and drive hub 3.

### Set begin of delivery (FB) :

For data for begin of delivery, see Engine Data.  
Remove the screws 5 and push the cover 6 from the timing case.  
Set cylinder 1 to the exact FB mark.

### Note:

The center of the two threaded holes on the inspection port flywheel housing are reference points.  
The flywheel is marked with the OT (Oberer Totpunkt = upper dead center) and the 10° to 30° marks.

Install a high pressure pump or overflow pipe on cylinder 1 of the injection pump. Turn off the starting boost. Release screws 7, turn the drive hub 3 via the clamp 8 with a commercially available nut wrench DIN 3116-C35 approx. 90° to the left (turning direction as seen from the fan side onto the engine). Actuate the pump, turn the drive hub 3 back to the right until fuel flows from the overflow pipe in droplets. FB is now set. Tighten the screws 7 according to the torque specification and check the FB (begin of delivery) again by turning the engine. If adjustment is correct, reinstall everything.

### Tightening torque for screws 7:

Pretorque Nm 30      40°  
Nm 110

### Set the begin of delivery (FB) with „EDC“ (Electronic regulation):

For data for begin of delivery, see Engine Data.  
Remove the plug on the injection pump regulator (EDC) and install light signal transmitter, Id. No. 6004308. Clamp the ground terminal of the light signal transmitter to the engine ground. The injection pump must be without power. Turn the ignition off.

### Proceed as described above, Set begin of delivery.

Turn back the drive hub 3 to the right until both lights on the light signal transmitter light up. The FB is now set. Tighten the screws 7 according to the torque specification and check the FB (begin of delivery) again by turning the engine. If adjustment is correct, reinstall everything.

### Turn off the starting boost:

Injection pump „A“ with RSV-Regulator:      see page 26

Injection pump „MW“ with RSV-Regulator and  
solenoid for release - starting boost:      see page 26

Injection pump „P“ with RSV-Regulator  
is the same as „MW“ injection pump:      see page 26

Injection pump „P“ with RSV-Regulator and:  
solenoid for release - starting boost      see page 26

is the same as „MW“ injection pump

**Injection pump „P“ with RQV- K-Regulator:**

The starting boost does not have to be turned off for setting the begin of delivery.

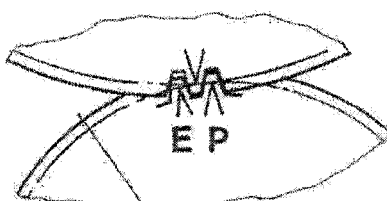
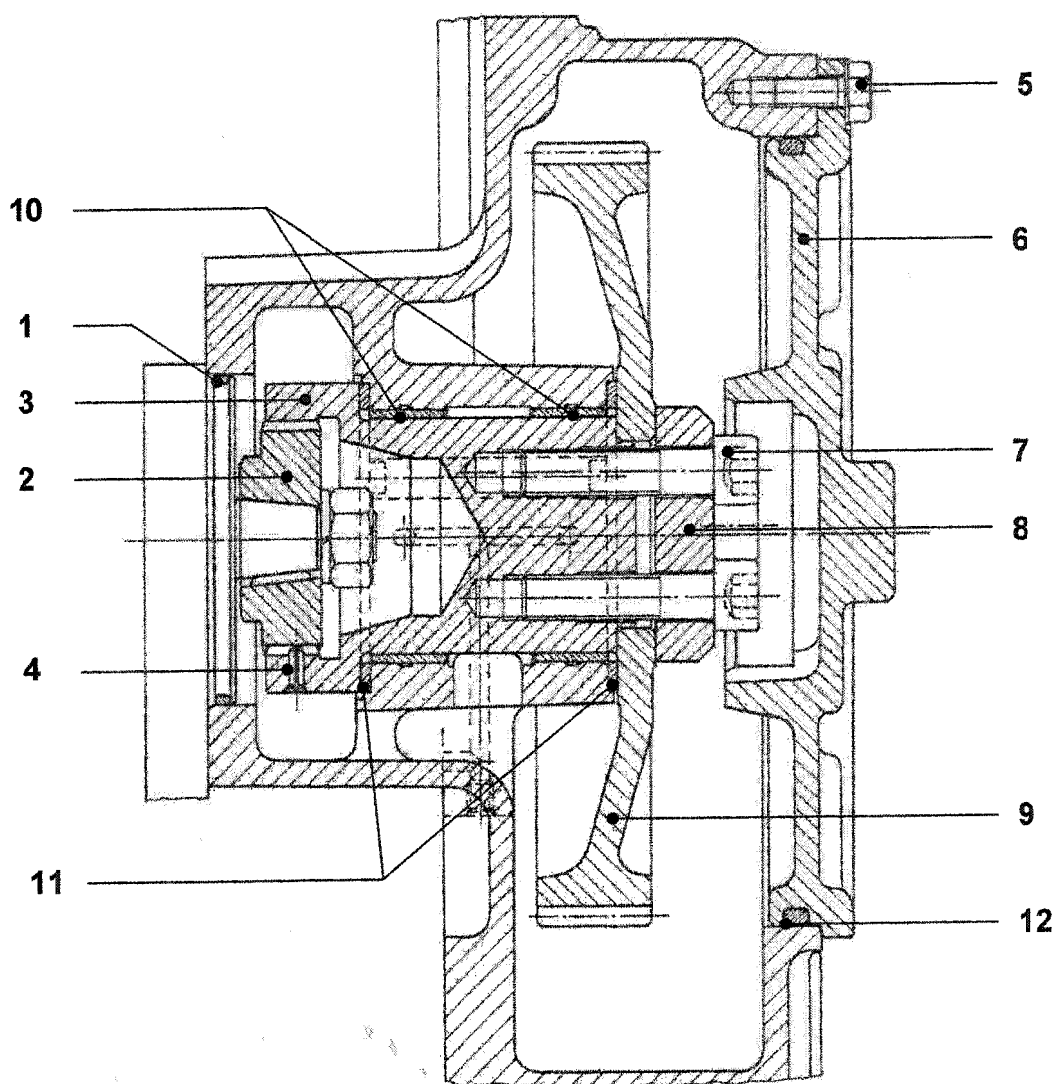
**Injection pump „P“ with EDC (Electronic regulation):**

The starting boost does not have to be turned off for setting the begin of delivery.

**Note:**

Injection pumps and regulator descriptions are noted on the data tag of the injection pump or regulator.

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Injection pump drive Adjust begin of delivery	Blatt Page Feuille	26.1



- |                |                   |
|----------------|-------------------|
| 8 O- ring      | 7 Screws          |
| 9 Gear shaft   | 8 Lock ring       |
| 10 Drive hub   | 9 Gear            |
| 11 Tension pin | 10 Bearing sleeve |
| 12 Screws      | 11 Thrust washer  |
| 13 Cover       | 12 O- ring        |

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model	D 904 / 914 / 924
		Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Injection pump drive Adjust begin of delivery		Blatt Page Feuille 26.1

## 26.2 Injection pump drive, adjust begin of delivery

### Drive integrated in timing case

Distributor injection pumps (VE) are installed on this drive.

The injection pump is connected to the drive via the gear shaft 2 and drive hub 3.

### Set begin of delivery (FB) :

For data for begin of delivery, see Engine Data.

Remove the screws 6 and push the cover 7 from the timing case.

Set cylinder 1 to OT (OT = upper dead center).

### Note:

The center of the two threaded holes on the inspection port flywheel housing are reference points.  
The flywheel is marked with the OT (Oberer Totpunkt = upper dead center) and the 10° to 30° marks.

Turn back the engine by 30° against the turning direction from the OT.

Loosen screws 8 and tighten them again with 30 Nm.

Remove the cap on the distributor head of the injection pump and install a test device into the distributor head. Insert the dial gauge and set under pretension of approx. 1 mm to „O“ and tighten.

Turn the engine in turning direction until FB is reached on the test gauge.

Loosen the retaining screw on the injection pump and remove the support plate. Tighten the retaining screw with 10 - 15 Nm.

Do not turn the engine any more. Loosen screws 8. Turn the engine approx. 30° against the turning direction, then turn the engine in turning direction until the OT mark is reached.

Tighten screws 8 with 30 Nm. Loosen the retaining screw on the injection pump, place a support plate underneath, and tighten the retaining screw with 10 - 15 Nm. Tighten the screws 8 according to torque specification and check the FB again by turning the engine.

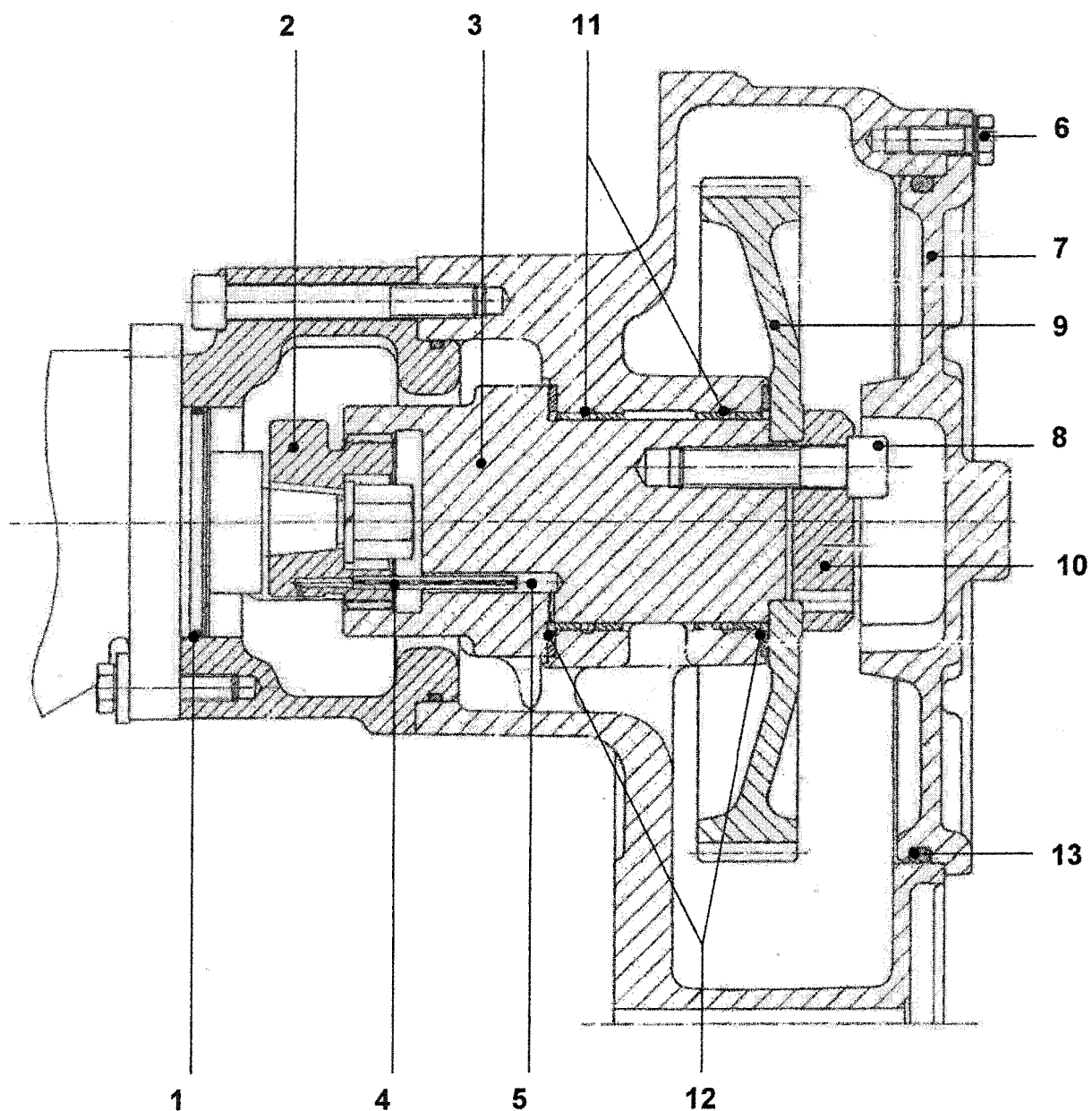
If adjustment is correct, reinstall everything.

**Tightening torque for screws 8:** Pre-torque Nm 30      40°  
Nm 110

### Note:

The injection pump description is noted on the data tag of the injection pump.





- |               |                   |
|---------------|-------------------|
| 1 O- ring     | 8 Screws          |
| 2 Gear shaft  | 9 Gear            |
| 3 Drive hub   | 10 Locking ring   |
| 4 Tension pin | 11 Bushing        |
| 5 Bore        | 12 Thrust washers |
| 6 Screws      | 13 O- ring        |
| 7 Cover       |                   |

**LIEBHERR**

Benennung / Description / Denomination

Typ  
Model  
Type D 924 / 926 T-E A1

Datum / Edition / Date  
12 / 2003

Injection pump drive  
Adjust begin of delivery

Blatt  
Page  
Feuille 26.2

## 26.3 Injection pump drive, adjust begin of delivery

### Drive is integrated in timing case

In-line injection pump size "H-RP43" (Control-sleeve injection pump ) are installed on this drive. The injection pump is connected to the drive via the gear shaft 2 and drive hub 3.

### Set the begin of delivery (FB) with " EDC" ( Electronic regulation):

For data for begin of the delivery, see Engine Data.

Remove the screws 5 and push the cover 6 from the timing case. Set cylinder 1 to the exact FB mark.

#### Note:

The center of the two threaded holes on the inspection port flywheel housing are reference points. The flywheel is marked with the OT (Oberer Totpunkt = upper dead center) and the marks from 20° before OT until 10° after OT.

Remove the plug on the injection pump regulator (EDC) and install light signal transmitter, Id. No. 6004308. Clamp the ground terminal of the light signal transmitter to the engine ground. The injection pump must be without power. Turn the ignition off.

Loosen screws 7, turn left drive hub 3 on screws 8 with a socket head screw to limit of the screws 7 on the oblong holes (Turning direction as seen from the fan side onto the engine).

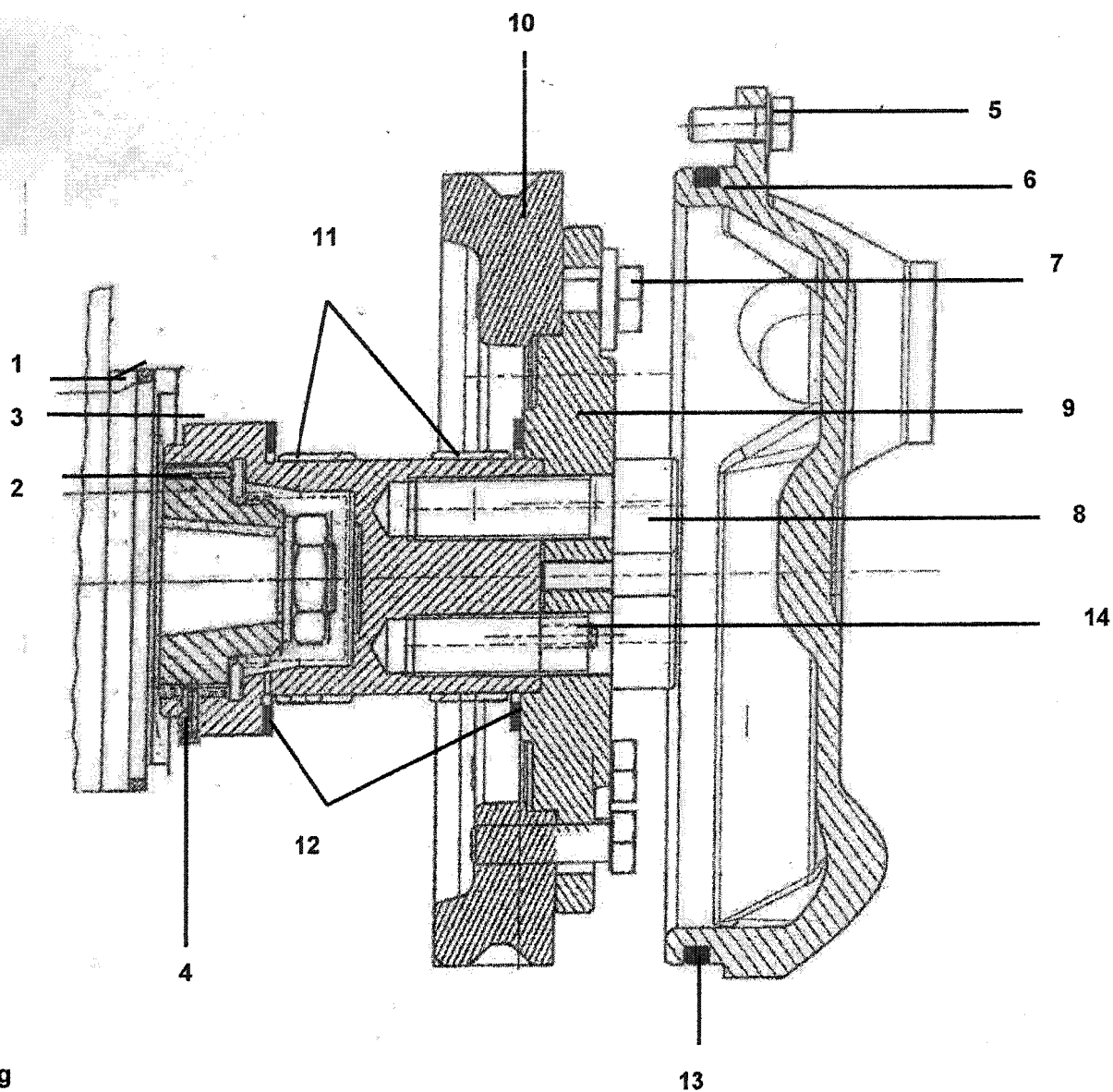
Slowly turn drive hub 3 to the right until both lights on the light signal transmitter light up. The FB is now set. Tighten the screws 7 according to the torque specification and check the FB ( begin of delivery) again by turning the engine. If adjustment is correct, reinstall everything.

**Tightening torque for screws 7:** Pretorque Nm 30    Nm 61

**Tightening torque for screws 8:** Pretorque Nm 30    Nm 250

#### Note:

The injection pump and regulator descriptions are marked on the data tag for the injection pump or the regulator.



- 1 O-ring
- 2 Gear shaft
- 3 Drive hub
- 4 Tension pin
- 5 Screws
- 6 Cover
- 7 Screws
- 8 Screws
- 9 Intermediate flange
- 10 Gear
- 11 Bearing sleeves
- 12 Thrust washer
- 13 O-ring
- 14 Adjusting pin

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Injection pump drive  
Adjust begin of delivery

Typ  
Model  
Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille  
26.3

## 27 Fuel injectors

The fuel injectors are accessible on the upper side of the cylinder heads and are attached with a retainer and two screws.

### Removal:

Remove injection lines and leak oil collector line. Remove screw 1, remove retainer 2 and spacer sleeve 3.

Knock the fuel injectors with the pulling device from the cylinder head. Remove the seal 4 from the fuel injector or from the bore in the cylinder head.

### Installation:

Attach new O-ring 5. Attach the seal 4 with grease on the fuel injector. Lubricate the fuel injector with grease and push into the bore in the cylinder head. Attach the retainer 2 and spacer sleeve 3. Insert screw 1 and tighten according to torque specification.

When tightening, tighten screw 1 on the spacer sleeve 3 first, then the other screw 1.

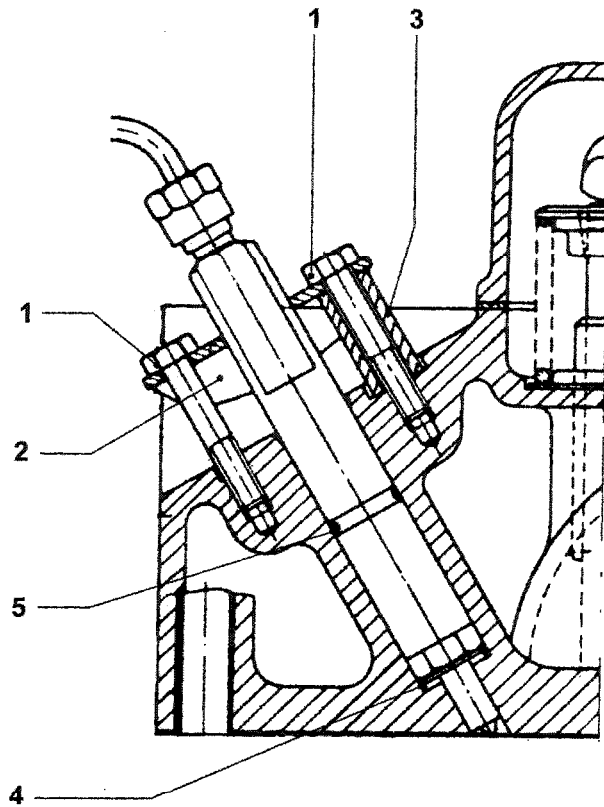
### Tightening torque for screw 1: Nm 23

Install leak oil collector line and injection lines.

### Important:

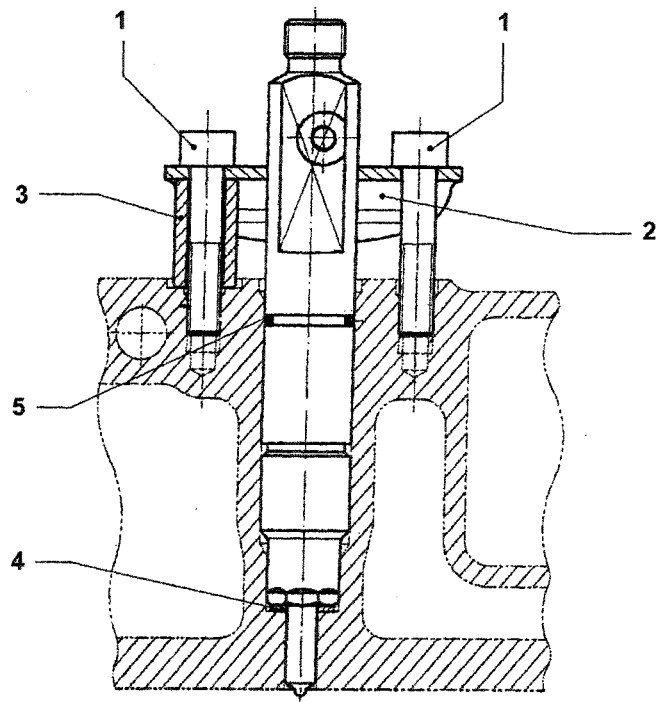
On D 904, 906, 914, 916, 926 TI engines, the leak oil connections on the fuel injectors must point to the flywheel side, on D 924 / 926 T / TI -E engines, to the injection pump side.

D 904 / 906 / 914 / 916 / 926 TI



Blatt 27-2

D 924 / 926 T/TI-E



Blatt 27-1

- 1. Mounting screws
- 2. Retainer
- 3. Spacer
- 4. Seal
- 5. O-ring

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Fuel injector

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page  
Feuille

27

## 27.1 Fuel injectors

### Function:

The fuel coming from the injection pump 1 under high pressure via the injection line flows via a rod filter 2 in the pressure channel 3 and from there to the nozzle seat 4.

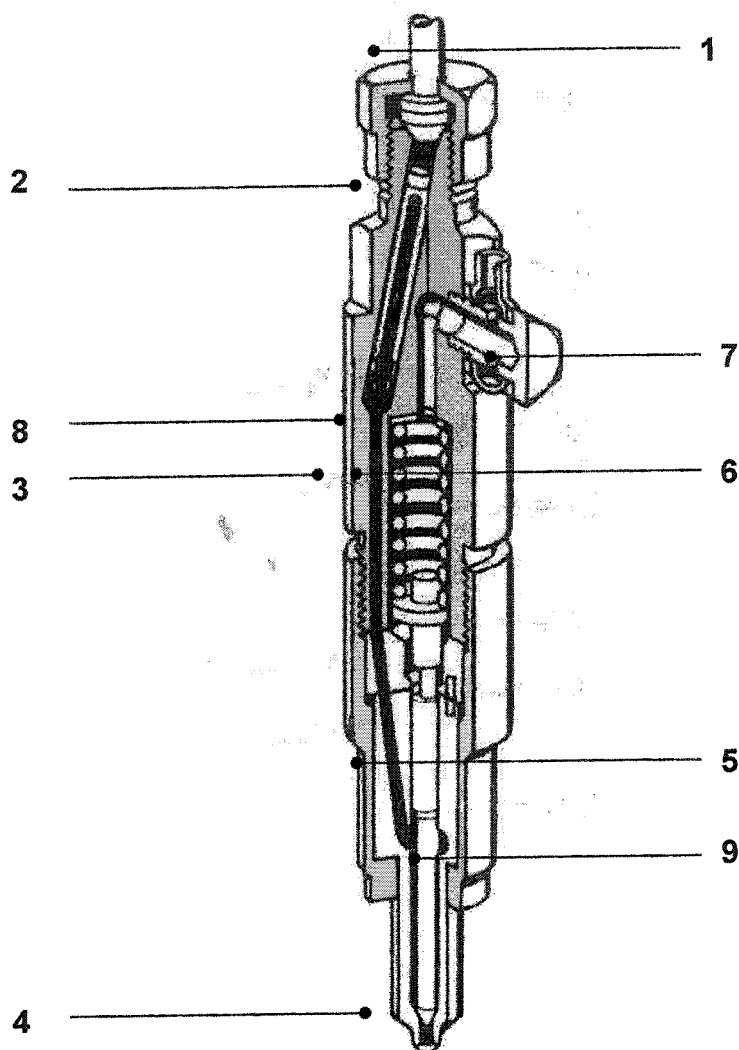
Due to the high pressure, the nozzle needle 5 is lifted and the fuel sprays into the combustion chamber. After a drop of the injection pressure, the spring 5 pushes the nozzle needle 5 back to the nozzle seat 4, ending the injection procedure. The leaking fuel along the nozzle needle 5 flows via leak oil connection 7 on the nozzle retainer and through the leak oil line back to the fuel tank.

The injection pressure can be adjusted via shims 8.

Engine	Nozzle Bosch description	Fuel injection pressure (bar) N = New B = operating pressure	Injection pump regulator
D 904 NA /TB D 906 NA /TB	DLLA 142 S 980	N = 260 <sup>+8</sup> B = 252 <sup>+8</sup>	RSV
D 904 T D 906 T / TI	DLLA 132 S 981	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	RQV
D 904 T D 906 T / TI	DLLA 142 S 980	N = 260 <sup>+8</sup> B = 252 <sup>+8</sup>	RSV
D 914 T / TI D 916 T / TI	DLLA 142 S 1189	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	RSV
D 926 TI	DLLA 142 S 1189	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	RSV / RQV - K
D 924 T-E (A 1, A2) D 926 T-E (A1, A2)	DLLA 145 P 632	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	RSV (A2)
D 924 TI-E (A2, A 3) D 926 TI-E (A2, A 3)	DLLA 145 P 632 DLLA 145 P 669	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	RSV (A2), RQV-K (A3)
D 924 TI-E A4 D 926 TI-E A4	DLLA 145 P 632 DLLA 145 P 669	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	EDC
D 924 TI-E A5	DLLA 145 P 669	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	EDC
D926 TI-E A5	DLLA 145 P 669	N = 225 <sup>+8</sup> B = 217 <sup>+8</sup>	EDC

### Torque specification for union nut 9:

D 904, 906, 914, 916, 926 TI      = Nm 50 <sup>+20</sup>  
D 924 / 926 TI-E                      = Nm 40 <sup>+10</sup>



1. Injection line
2. Rod filter
3. Pressure channel
4. Nozzle seat
5. Nozzle pin
6. Spring
7. Leak oil connection
8. Shims
9. Union nut

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Fuel injector	Blatt Page Feuille 27.1

## 28 Engine exhaust

The engine exhaust is a closed version.

The oil separator can be installed on the exhaust side of the engine in a pipe, depending on the engine model, or on new versions on the upper side of the timing case.

The oil separators come in two sizes.

### Function of oil separator „small version“:

The lower section of the oil separator is equipped with a filter section made of steel wool 1. In the upper section is a membrane 2, which is controlled by a spring 3 (membrane valve). Two bleeder holes 4 in cover 5 are used to regulate the membrane valve. Due to the vacuum pressure of the engine, oil flows from the crankcase to the oil separator. Most of the oil is discharged in the filter 1 and runs back via the valve plunger chamber into the oil pan. The discharge gases mixed with oil - air mixture are returned via the membrane valve or via the pipe line 6 to the engine and burnt.

### Check the crankcase vacuum pressure:

Pull the dipstick and connect the gauge on the dipstick guide tube.

Start the engine and bring to maximum RPM.

Read the crankcase vacuum pressure on the gauge and compare with test values.

### Note:

The engine must be in horizontal position for the test, it must be at operating temperature and the oil level must be correct.

### Test values:

Flow quantity:	$75 \pm 10$ l/min
Vacuum pressure:	$-250 \pm 20$ mm WS
Crankcase vacuum pressure:	-30 to - 80 mm WS

### Removal:

Loosen the hose clamps 7 on pipe 6 and push the hose 8 from the oil separator.

Remove the retainer 9, loosen the mounting clamp 10 and remove the oil separator.

### Installation:

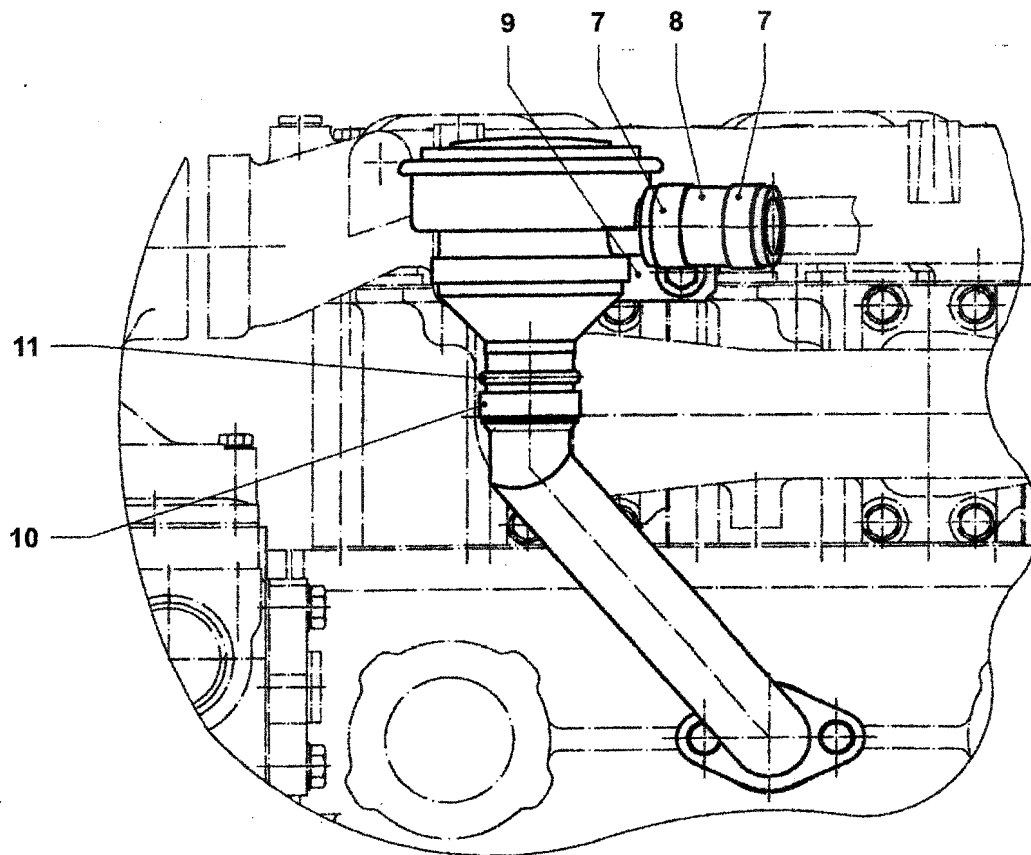
Place a new O-ring 11 into the oil separator. Push the oil separator onto the pipe. Push hose 8 onto pipe 6 and tighten hose clamps 7. Install retainer 9 and tighten mounting clamp 10.

### Note:

A damaged oil separator, for example one with a damaged cover 5, emerging oil vapor on two bleeder bores 4 of the membrane vent is not functioning properly and must be replaced. Replace the oil separator if the given crankcase vacuum pressure cannot be obtained or once every two years.

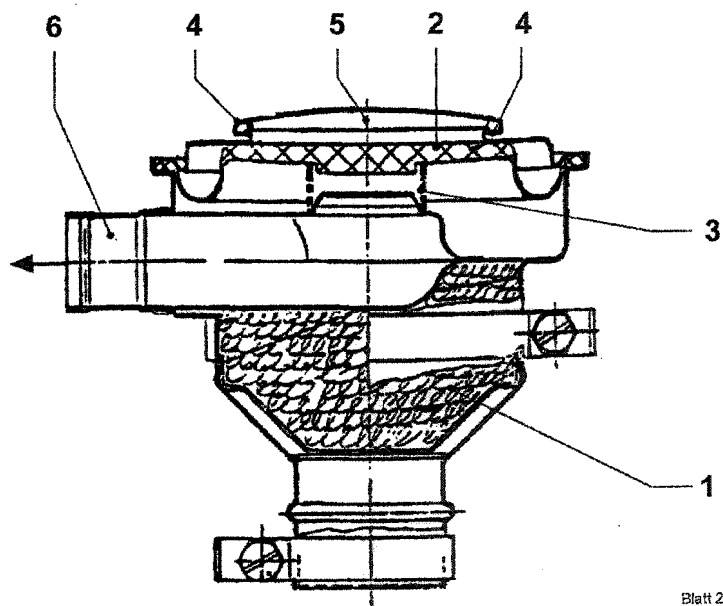


## Oil separator "small version"



Blatt-26-1

1. Filter section
2. Membrane
3. Spring
4. Vents
5. Cover
6. Pipe line
7. Hose clamps
8. Hose section
9. Retainer
10. Mounting clamp
11. O-ring



Blatt 28-2

**LIEBHERR**

Benennung / Description /  
Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Engine exhaust

Blatt  
Page 28  
Feuille

## 28.1 Engine exhaust

### Function oil separator „large version“:

The lower section of the oil separator is equipped with a filter section made of steel wool 1. In the upper section is a membrane 2, which is controlled by a spring 3 ( membrane valve). A membrane vent 4 in cover 5 is used to regulate the membrane valve. Due to the vacuum pressure of the engine, oil flows from the crankcase to the oil separator. Most of the oil is discharged in the filter 1 and runs via pipe 6 and cap 7 back into the oil pan. The discharge gases mixed with oil – air mixture are returned via the membrane valve or via the pipe line 8 to the engine and burnt.

### Check the crankcase vacuum pressure:

Pull the dipstick and connect the gauge on the dipstick guide tube.

Start the engine and bring to maximum RPM.

Read the crankcase vacuum pressure on the gauge and compare with test values.

### Note:

The engine must be in horizontal position for the test, it must be at operating temperature and the oil level must be correct.

### Test values:

Flow quantity;	100 ± 20 l /min
Vacuum pressure:	-200 ± 20 mm WS
Crankcase vacuum pressure:	-10 to - 80 mm WS

### Removal:

For installation with pipe line on valve plunger chamber, see page 28.

Loosen the hose clamps 9 on pipe 8 and push the hose 10 from the oil separator.

Remove the mounting clamp 11 and remove the oil separator from the timing case.

### Installation:

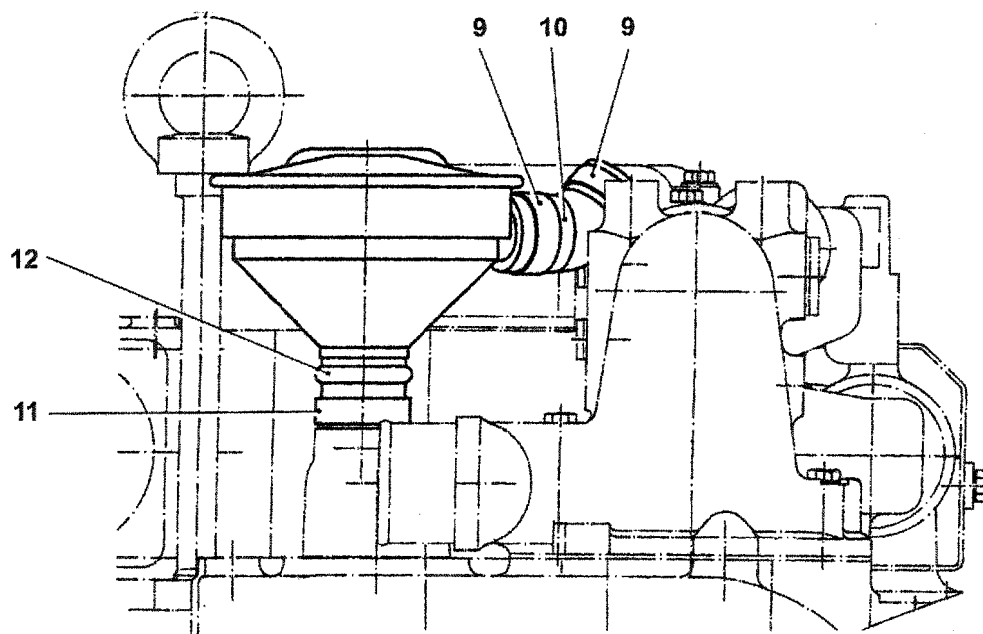
Place a new O-ring 12 into the oil separator. Push the oil separator onto the fitting in the timing case. Push hose 10 onto pipe 8, attach hose clamps 9 and tighten. Tighten mounting clamp 11.

### Note:

A damaged oil separator, for example one with a damaged cover 5, emerging oil vapor on two bleeder bores 4 of the membrane vent is not functioning properly and must be replaced.

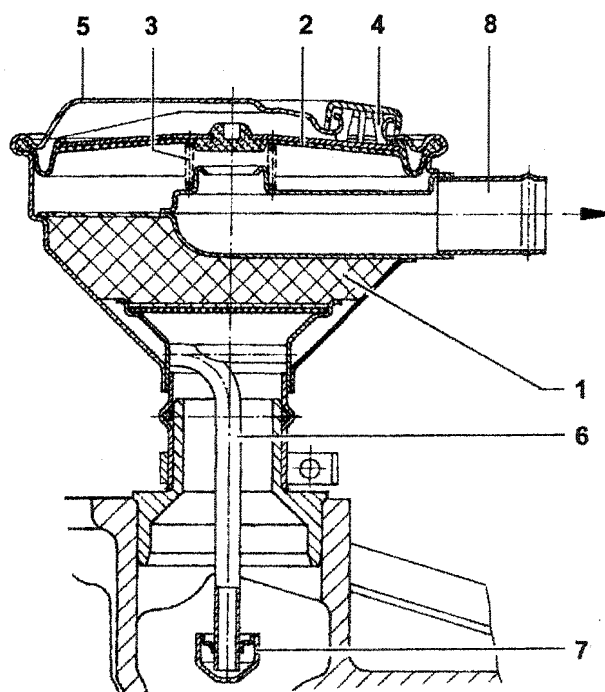
Replace the oil separator if the given crankcase vacuum pressure cannot be obtained or once every two years.

## Oil separator "large version"



Blatt28-1.2

1. Filter section
2. Membrane
3. Spring
4. Membrane vent
5. Cover
6. Return pipe
7. Cap
8. Pipe line
9. Hose clamps
10. Hose section
11. Mounting clamp
12. O-ring



Blatt 28-1-1

**LIEBHERR**

Benennung / Description /  
Denomination

Typ  
Model  
Type

D 914 / 924  
D 916 / 926

Datum / Edition /  
Date  
12 / 2003

Engine exhaust

Blatt  
Page  
Feuille

28.1

## 29 Fan and flywheel side crankshaft seal

### Fan-side crankshaft seal

The fan-side crankshaft seal ring 1 is installed in a seal ring holder 2.

#### Removal:

Remove the screws 3, remove the V-belt 4 and the vibration damper 5. Remove screws 6 and remove hub 7 from the crankshaft. Remove screws 8 and remove the seal ring holder 2 together with the seal ring 1 from the timing case.

#### Note:

The vibration damper 5 is not installed on all engine models.

#### Installation:

Press the new seal ring 1 into the seal ring holder 2 to the given dimension. Push the seal ring holder 2 with seal ring 1 and new, lubricated O-ring 9 into the timing case. Insert screws 8 and tighten. Push hub 7 onto the crankshaft, install screws 6 and tighten, see torque specifications. Attach the vibration damper 5 and V-belt 4. Install screws 3 and tighten, see torque specifications.

**Tightening torque for screws 6:** Pretorque Nm 30

M12 x 1,5 x 160  
 $\angle^{\circ} 45 + 45 = 90$   
Nm 100 - 160 = 160

M16 x 1,5 x 160  
 $\angle^{\circ} 40 + 30 + 30 = 100$   
Nm 100 - 300 = 300

**Tightening torque for screws 3:** Pretorque Nm 30

M12 x 45  
 $\angle^{\circ} 30 + 15 = 45$   
Nm 90 - 140 = 140

M12 x 45  
Nm 70 - 110 = 110

M16 x 1,5 x 160  
Nm 300

#### Note:

In case of wear grooves in hub 7, the seal ring 1 can be relocated toward the engine side in the seal ring holder 2.

### Flywheel-side crankshaft seal:

The flywheel-side crankshaft seal ring 10 is also installed in a seal ring holder 11.

#### Removal:

Remove screws 12 on the flywheel 13 and remove the flywheel 13 from the crankshaft and the dowel pin 14. Remove screws 15 and remove the seal ring holder 11 together with seal ring 10 from the flywheel housing.

**Installation:**

Press the new seal ring 10 into the seal ring holder 11. Push the seal ring holder 11 with seal ring 10 and new, lubricated O-ring 16 with the installation sleeve onto the crankshaft. Install screws 15 and tighten. Push the flywheel 13 onto the crankshaft and dowel pin 14. Insert screws 12 and tighten, see torque specifications.

**Tightening torque for screws 12:**

Pretorque Nm 30                      M14 x 1,5 x 50  
     $\angle^{\circ} 30 + 35 = 65$   
    Nm 180 – 330 = 330

M16 x 1,5 x 50  
 $\angle^{\circ} 30 + 25 = 55$   
Nm 180 – 330 = 330

Pretorque Nm 90                      M16 x 1,5 x 130  
     $\angle^{\circ} 30 + 30 + 40 = 100$   
    Nm 180 – 330 = 330

**Note:**

In case of wear grooves in the crankshaft, the seal ring 10 can be relocated toward the engine side in the seal ring holder 11.

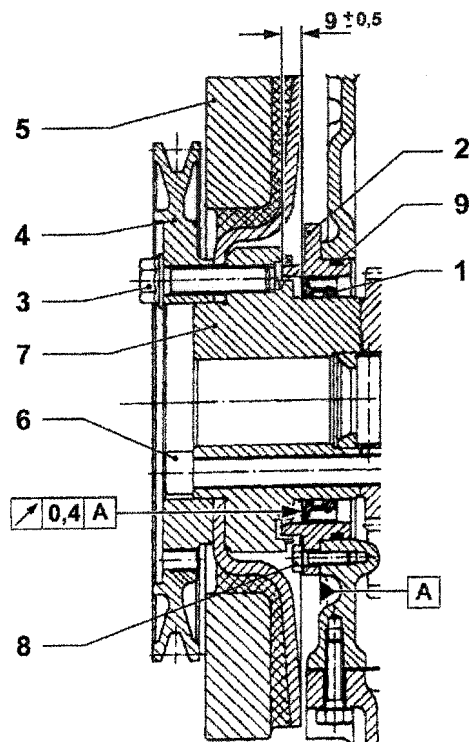
**Note:**

When installing the crankshaft seal rings 1 and 10, fill the gap between the protector and seal lip with grease (Molykote Longterm 2 Plus) .

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type	D 904 / 914 / 924
			D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Fan and flywheel side crankshaft seal	Blatt Page Feuille	29

## Fan side crankshaft seal

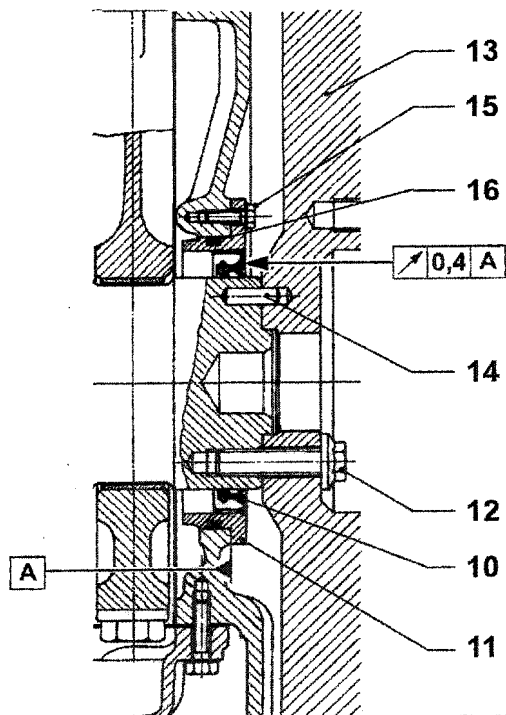
- 1 Shaft seal ring
- 2 Seal ring holder
- 3 Screws for V-belt pulley
- 4 V-belt pulley
- 5 Vibration damper
- 6 Screws for hub
- 7 Hub
- 8 Screws for seal ring holder
- 9 O-ring



Blatt 29-2

## Flywheel side crankshaft seal

- 10 Shaft seal ring
- 11 Seal ring holder
- 12 Screws for flywheel
- 13 Flywheel
- 14 Pin
- 15 Screws for seal ring holder
- 16 O-ring



Blatt 29-1

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Fan and flywheel side crankshaft seal

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page  
Feuille 29

## 30 Hydraulic pump auxiliary drive

Installation on timing case below the injection pump.

RPM:	Engine <sup>1</sup> /min	= 1500, 1800, 2000, 2100
	Auxiliary drive <sup>1</sup> /min	= 1914, 2297, 2552, 2679

Permissible continuous output: 27 KW (37 PS)  
at even operation

### Note:

In case of changes on series installation, contact the engine manufacturer.

### Removal:

Remove the lube oil supply line 1 and remove the screws 2.  
Remove the intermediate flange 3 from the timing case. Remove the gear 4 from the timing case.

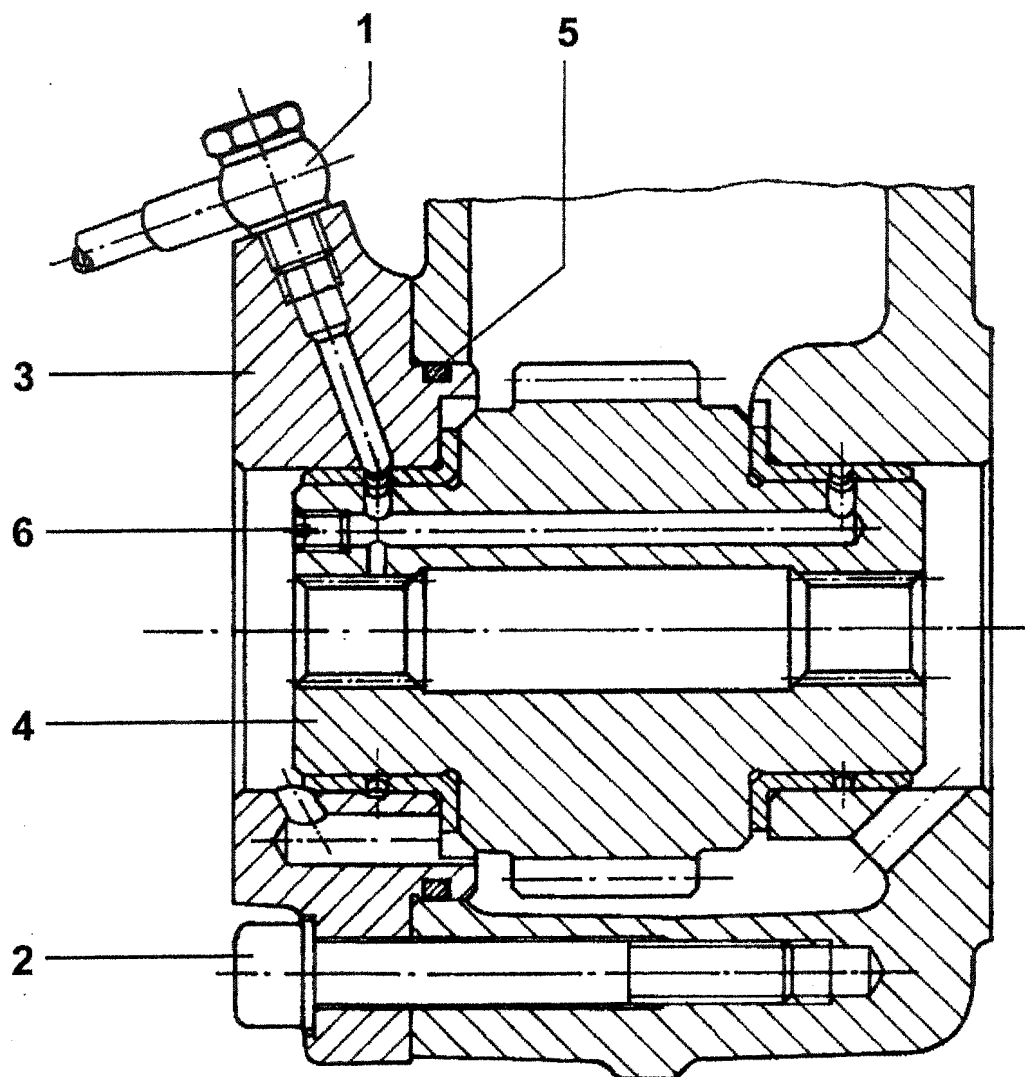
### Installation:

Lubricate and attach new O-ring 5 on the intermediate flange 3.  
Push gear 4 into the bushing in the timing case in such a way that the lube oil plug 6 points to the injection pump.  
Push the intermediate flange 3 onto gear 4 and into the timing case. Insert screws 2 and tighten. Install the lube oil supply line 1.

### Important:

After every installation or repair on the auxiliary drive, check the axial play when installed.

Axial play normal:	0.12 - 0.37 mm
Limit value:	0.55 mm



Blatt 30

1. Lube oil supply line
2. Mounting screws
3. Intermediate flange
4. Gear
5. O-ring
6. Lube oil plug

<b>LIEBHERR</b>	Benennung / Description / Denomination  Hydraulic pump auxiliary drive	Typ Model Type D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003		Blatt Page Feuille 30



## 30.1 Hydraulic pump auxiliary drive

### Installation on flywheel housing

RPM:      Engine  $\frac{1}{\text{min}}$                       = 1500, 1800, 2000, 2100  
             Auxiliary drive  $\frac{1}{\text{min}}$        = 1794, 2153, 2392, 2512

Permissible continuous output : 77 kW ( 105 PS) at even operation.

#### Note:

In case of changes on series installation, contact the engine manufacturer.

#### Removal:

Remove oil drain plug on flywheel housing and drain oil. Remove the lube oil supply tube from the crankcase to the auxiliary drive. Turn out mounting screws 1 on the auxiliary drive, hold nut 2 on.

Remove auxiliary drive from flywheel housing.

#### Installation:

Install new O-rings 3, 4 and lightly grease it. Push auxiliary drive into flywheel housing (assure tooth mesh).

Install mounting screws 1, washers and nuts 2 and tighten.

Install lube oil tube, install and tighten oil drain plug.

Fill approx. 1 liter engine oil through oil filler neck.

#### Note:

After installation start engine, turn the engine off and check the engine oil level.

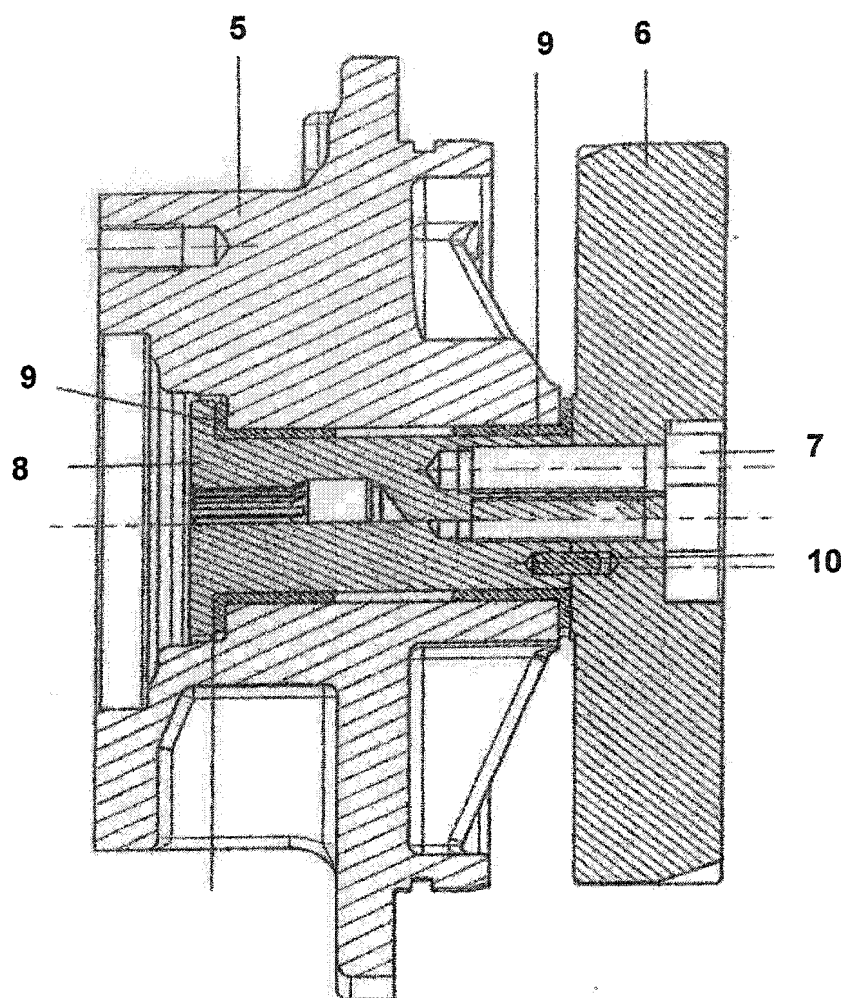
If necessary correct the oil level.

#### Important:

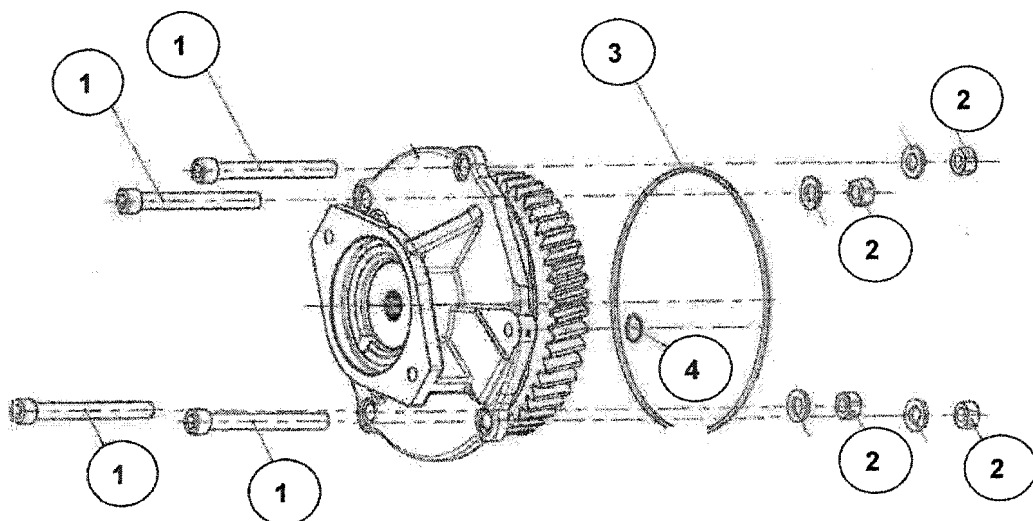
After every installation or repair, check the axial play on the auxiliary drive.

Axial play normal : 0,05 – 0,25 mm

Limit value        : 0,55 mm



- 1 Mounting screws
- 2 Nuts
- 3 O-ring
- 4 O-ring
- 5 Housing
- 6 Gear
- 7 Screws
- 8 Hub
- 9 Collar bearing
- 10 Adjusting pin



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Hydraulic pump auxiliary drive

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page 30.1  
Feuille

### 30.2 Hydraulic pump auxiliary drive Installation on flywheel housing

**Drive- shift able**

RPM: Engine <sup>1</sup>/min = 1500, 1800, 2000, 2100  
Auxiliary drive <sup>1</sup>/min = 2229, 2675, 2972, 3120

Permissible continuous output : 192 kW (261 PS) at even operation.

**Note:**

In case of changes on series installation, contact the engine manufacturer.

**Removal:**

Remove oil drain plug on flywheel housing and drain oil. Remove air pressure lines. Disconnect cable to proximity switch 1. Turn out mounting screws 2 on the auxiliary drive, hold nut 2 on.  
Remove auxiliary drive from flywheel housing.

### Installation:

Install new O-rings 4, 5 and lightly grease it. Push auxiliary drive into flywheel housing (assure tooth mesh). Install mounting screws 2, washers and nuts 3 and tighten. Install cable from proximity switch 1 and air pressures lines.  
Install and tighten oil drain plug.  
Fill approx. 1 liter engine oil through oil filler neck.

**Note:**

If the proximity switch 1 is removed, read just it to the given measurement after reinstallation.  
After installation start engine, turn the engine off and check the engine oil level.  
If necessary correct the oil level.

**Tightening torque for slotted nut 8 :**

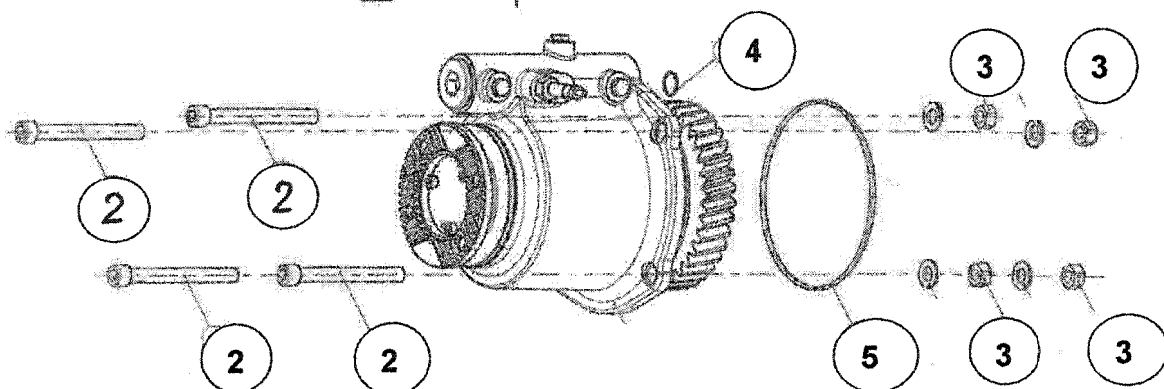
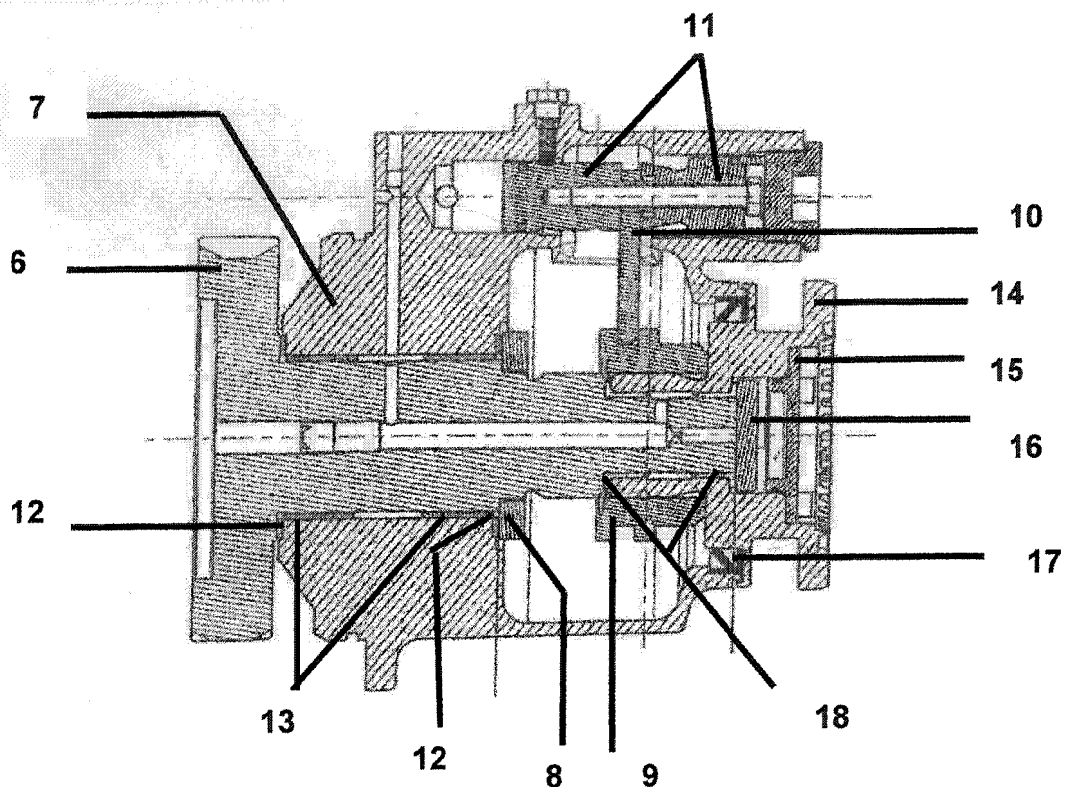
Pretorque Nm 30      Nm 300  
Retainer : Loctite 243

**Important:**

After every installation or repair, check the axial play on the auxiliary drive.

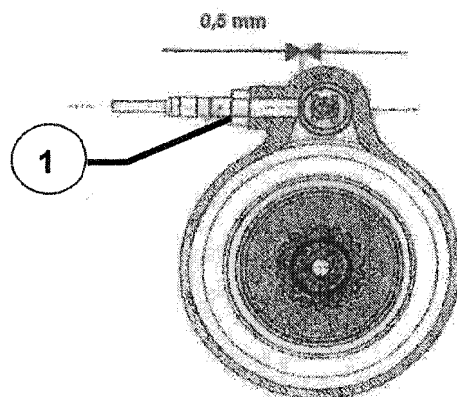
**Gear side:** Axial play normal : 0,05 – 0,25 mm  
Limit value : 0,55 mm

**Power take-off side:** Axial play normal: 0,15 – 0,35 mm  
Limit value : 0,55 mm



- 1 Proximity switch
- 2 Mounting screws
- 3 Nuts
- 4 O-ring
- 5 O-ring
- 6 Gear shaft
- 7 Housing
- 8 Slotted nut
- 9 Coupling ring
- 10 Shifting fork
- 11 Adjusting piston

- 12 Thrust rings
- 13 Bushings
- 14 Connecting flange
- 15 Sealing cover
- 16 Thrust ring
- 17 Shaft seal ring
- 18 Collar bearing



**LIEBHERR**

Benennung / Description / Denomination

Hydraulic pump auxiliary drive

Typ Model Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Datum / Edition / Date  
12 / 2003

Blatt Page Feuille  
30.2

### **30.3 Hydraulic pump auxiliary drive Installation on drive gear box for fan drive**

RPM:            Engine <sup>1</sup>/min    = 1500, 1800, 2000, 2100  
                 Auxiliary drive   = 1850, 2219, 2466, 2589

Permissible continuous output: 29,5 kW ( 40 PS) at even operation.

#### **Note:**

In case of changes on series installation, contact the engine manufacturer.

#### **Removal:**

Loosen screws 1 and remove it. Remove auxiliary drive from timing case.

#### **Installation:**

Install new O-rings 2, 3 on auxiliary drive and lightly grease it.  
Push auxiliary drive into the drive gear box ( assure tooth mesh ) insert and tighten screws 1.

#### **Note:**

The slotted nut 4 has a left handed thread.

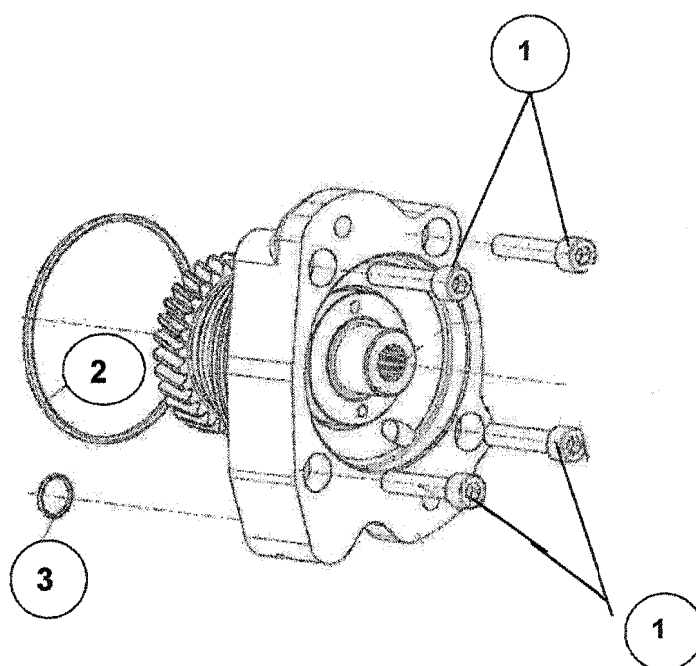
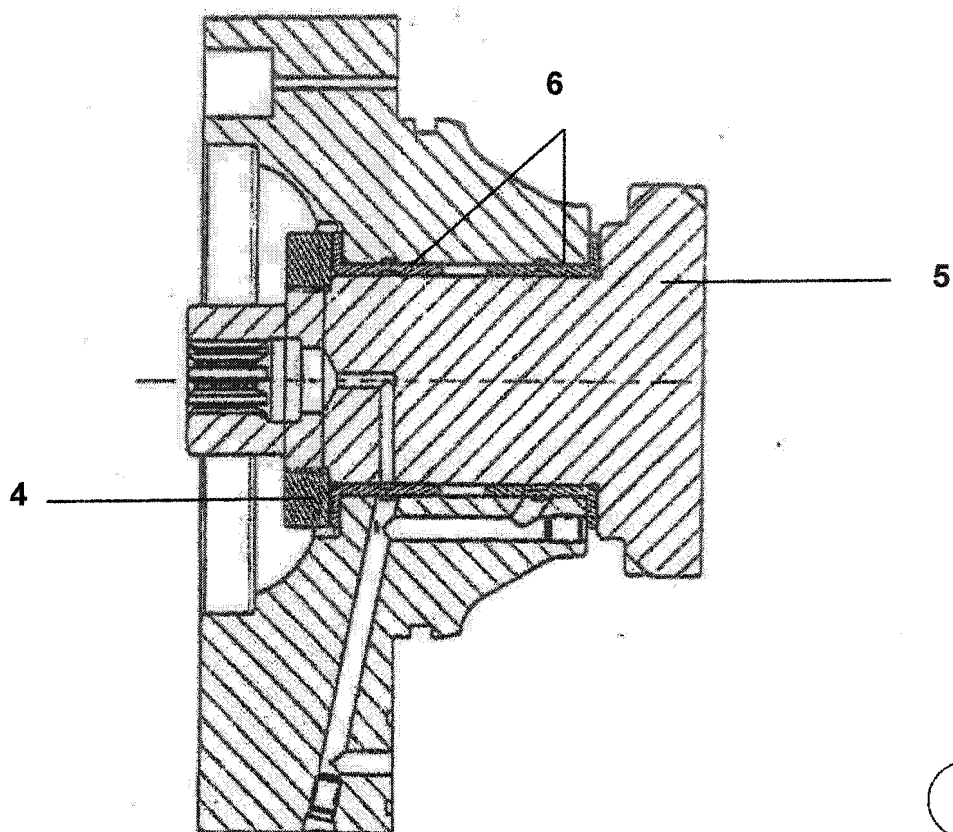
#### **Tightening torque for slotted nut 4 :**

Pretorque Nm 30                      Nm 240  
Retainer : Loctite 243

#### **Important:**

After every installation or repair on the auxiliary drive, check the axial play.

Axial play normal: 0,05 – 0,25 mm  
Limit value        : 0,55 mm



- 1. Mounting screws
- 2. O-ring
- 3. O-ring
- 4. Slotted nut
- 5. Hub
- 6. Collar bearing

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Dénomination

Hydraulic pump auxiliary drive

Typ  
Model  
Type

D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille

30.3

## 31 Air compressor

On earlier engine versions, the air compressors were installed with air cooled cylinder head. Newer versions feature air compressors with coolant cooled cylinder head, they are connected to the cooling circuit of the engine for cooling.

The air compressor is driven via a gear.

RPM:	Engine n <sup>1</sup> /min	= 1500, 1800, 2000, 2100
	Air compressor n <sup>1</sup> /min	= 1914, 2297, 2552, 2679

### Removal:

Remove the air suction and pressure line on the air compressor head.

### Note:

#### Markings on the air compressor head:

- 0 = Suction connection
- 2 = Pressure connection

On coolant cooled air compressors, remove the coolant supply and coolant return line. Remove the lube oil supply line.

Remove nuts 1, remove spring washers 2 and take the air compressor 3 from the timing case. Remove nut 4 and pull the gear 5 with commercially available gear puller from the shaft.

### Installation:

Push gear 5 onto the shaft. Attach nut 4 and tighten according to torque specification.

Place new O-ring 6 with grease into the groove on the air compressor flange. Push the air compressor 3 into the timing case (note the tooth mesh). Attach spring washers 2 and nuts 1 and tighten.

Install the lube oil supply line. Install air lines and - on the coolant cooled air compressor - the coolant supply line and the coolant return line.

Add coolant.

Torque specification for nut 4:	M 18 x 1,5	M 20 x 1,5	M 20 x 1,5
	Nm 80 <sup>+10</sup>	(SW = 30 mm) Nm 150	(SW = 27 mm) Nm 200

## 32 Starter

Depending on the engine model, 4 KW, 5,4 KW, 6,6 KW and 9 KW Starters are installed.

### Removal:

Disconnect the battery and remove the electrical lines from the starter.

Remove nuts 1 and remove the spring washers 2.

Take the starter 3 from stud screws 4 in the flywheel housing.

### Note:

On starters, which are sealed towards the flywheel housing, there is an O-ring 5 on the starter flange.

Check O-ring 5 and replace it if necessary. Before installation, lubricate it lightly with grease .

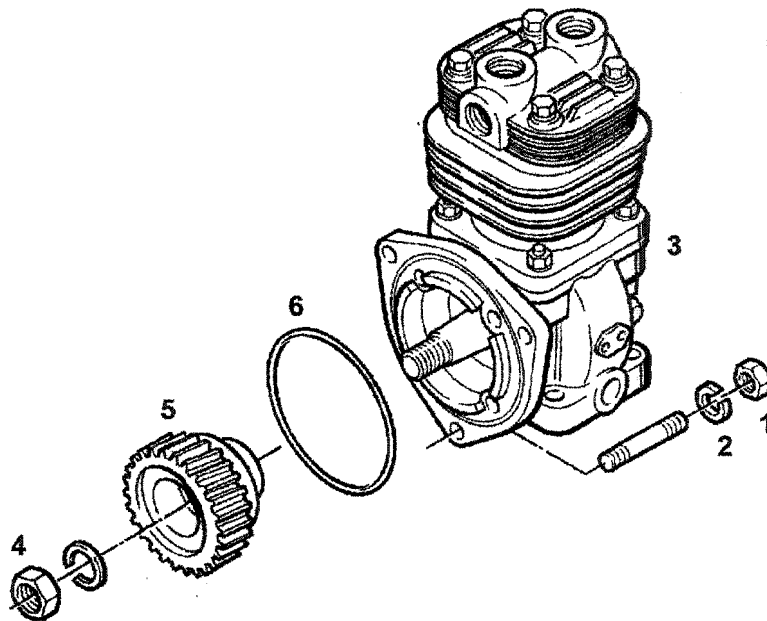
### Installation:

Push the starter 3 over the stud screws 4 on the flywheel housing. Attach spring washers 2 and nuts 1 and tighten.

Attach the electrical lines on the starter and attach the battery cable.



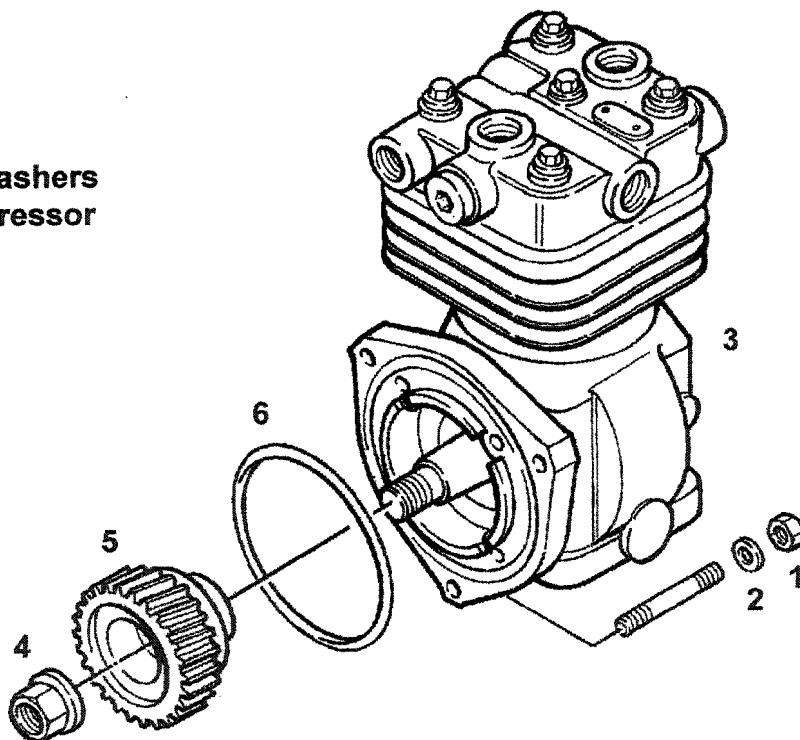
## Air compressor "air cooled"



Blatt 31

## Air compressor "coolant cooled"

1. Nuts
2. Spring washers
3. Air compressor
4. Nut
5. Gear
6. O-ring



Blatt 31-1

**LIEBHERR**

Benennung / Description /  
Denomination

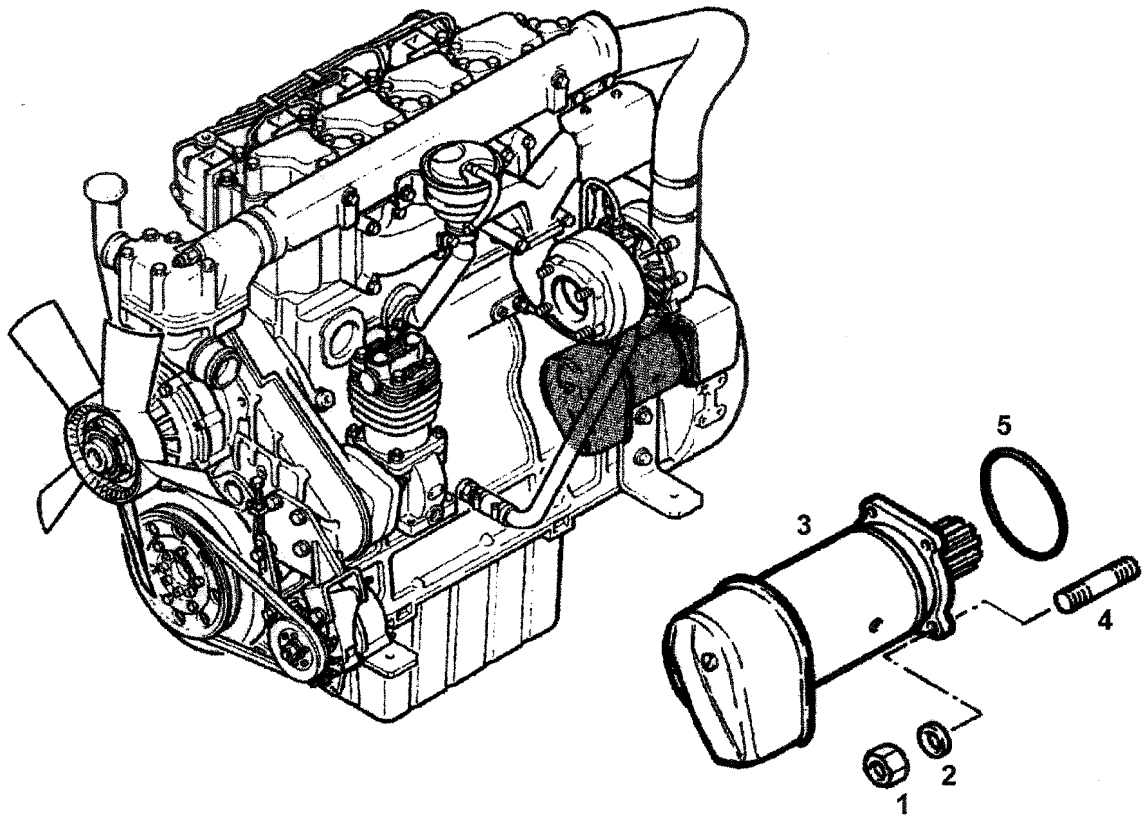
Air compressor

Typ      D 904 / 914 / 924  
Model   D 906 / 916 / 926  
Type

Datum / Edition /  
Date  
12 / 2003

Blatt  
Page  
Feuille

31



Blatt 32

- 1 Nuts
- 2 Spring washers
- 3 Starter
- 4 Stud screws
- 5 O-ring

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Starter

Typ            D 904 / 914 / 924  
Model        D 906 / 916 / 926  
Type

Blatt  
Page  
Feuille            32

### 33 Air conditioner compressor and alternator

Up to engine No. 98 01 0814

#### Note:

Screws 1, 3 on tension pulleys 2, 4 are socket head screws up to the above engine No.

#### Check the V-belt tension:

##### Check by hand:

The V-belt 5 is tensioned correctly if it can be pushed down on the given test point with a force of 120 N by 13 mm.

##### Check with „Kriket 2“ tester, Id. No. 8042829:

Lower the indicator arm A in the test unit, set the test unit on the given test points. Push the button D evenly at a right angle to the V-belt until the spring disengages. Carefully remove the test unit and read the value on the point of intersection of the „KG“ scale and the indicator arm A.

Compare the test value with the chart.

V-belt	New V-belt KG scale	Run-in V-belt KG scale
8 grooves approx. 28 mm wide	50	40 - 50

#### Adjustment:

Loosen screw 1 and preset the tension pulley 2 with wrench (SW 36) in clockwise direction to 45°. Tighten the screw 1. Loosen screw 3 and turn the tension pulley 4 with wrench (SW 36) in clockwise direction until the correct V-belt tension is reached. Tighten screw 3. Check the V-belt tension again.

#### Change V-belt:

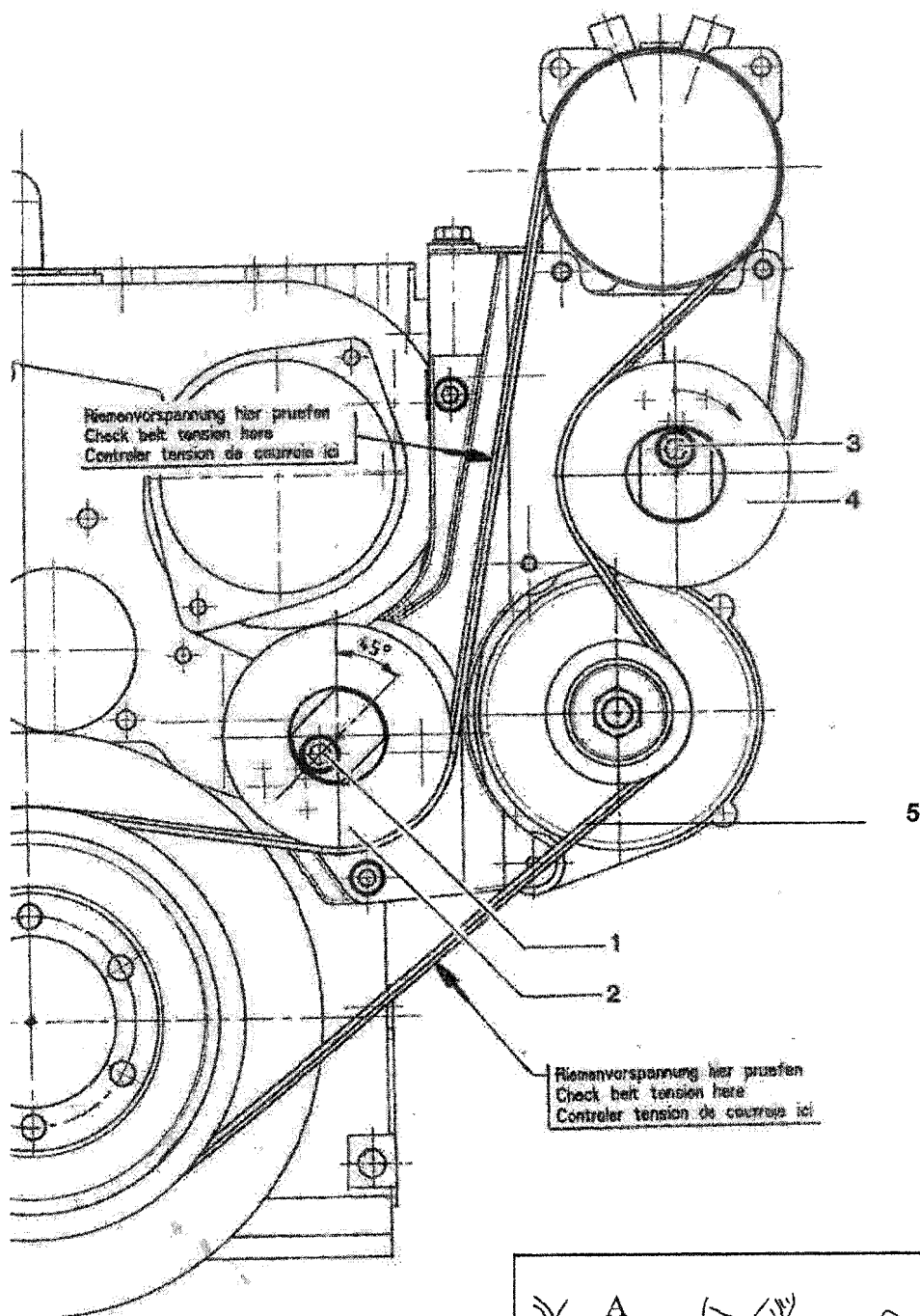
Loosen screws 1, 3 and turn the tension pulley 2, 4 with wrench (SW 36) in counterclockwise direction.

Remove the V-belt 5.

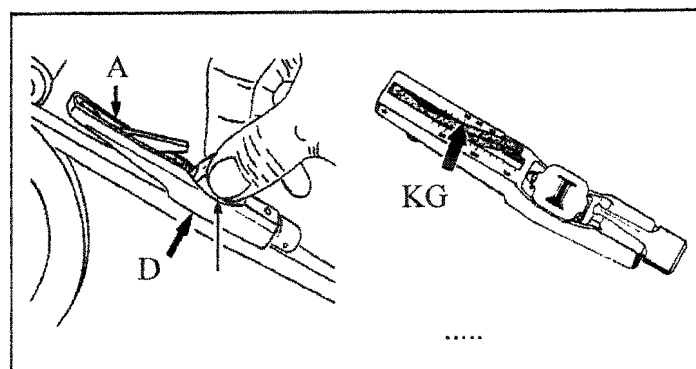
Place a new V-belt 5 and adjust it. Tighten everything again.

#### Important:

Let new V-belt 5 run-in about 15 - 20 minutes. Recheck the tension and retension, as necessary.



- 1 Screw
- 2 Tension pulley
- 3 Screw
- 4 Tension pulley
- 5 V-belt



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

Air conditioner compressor and alternator

Typ  
Model  
Type

D 924 / 926

Blatt  
Page  
Feuille

33

## 33.1 Air conditioner compressor and alternator

From engine No. 98 01 0815

### Note:

Screws 1, 3 on tension pulleys 2, 4 are socket head screws up to the above engine No.

### Check the V-belt tension:

#### Check by hand:

The V-belt 5 is tensioned correctly if it can be pushed down on the given test point with a force of 120 N by 13 mm.

#### Check with „KrikIt 2“ tester, Id. No. 8042829:

Lower the indicator arm A in the test unit, set the test unit on the given test points. Push the button D evenly at a right angle to the V-belt 5 until the spring disengages. Carefully remove the test unit and read the value on the point of intersection of the „KG“ scale and the indicator arm A.

Compare the test value with the chart.

V-belt	New V-belt KG scale	Run-in V-belt KG scale
8 grooves approx. 28 mm wide	50	40 - 50

### Adjustment:

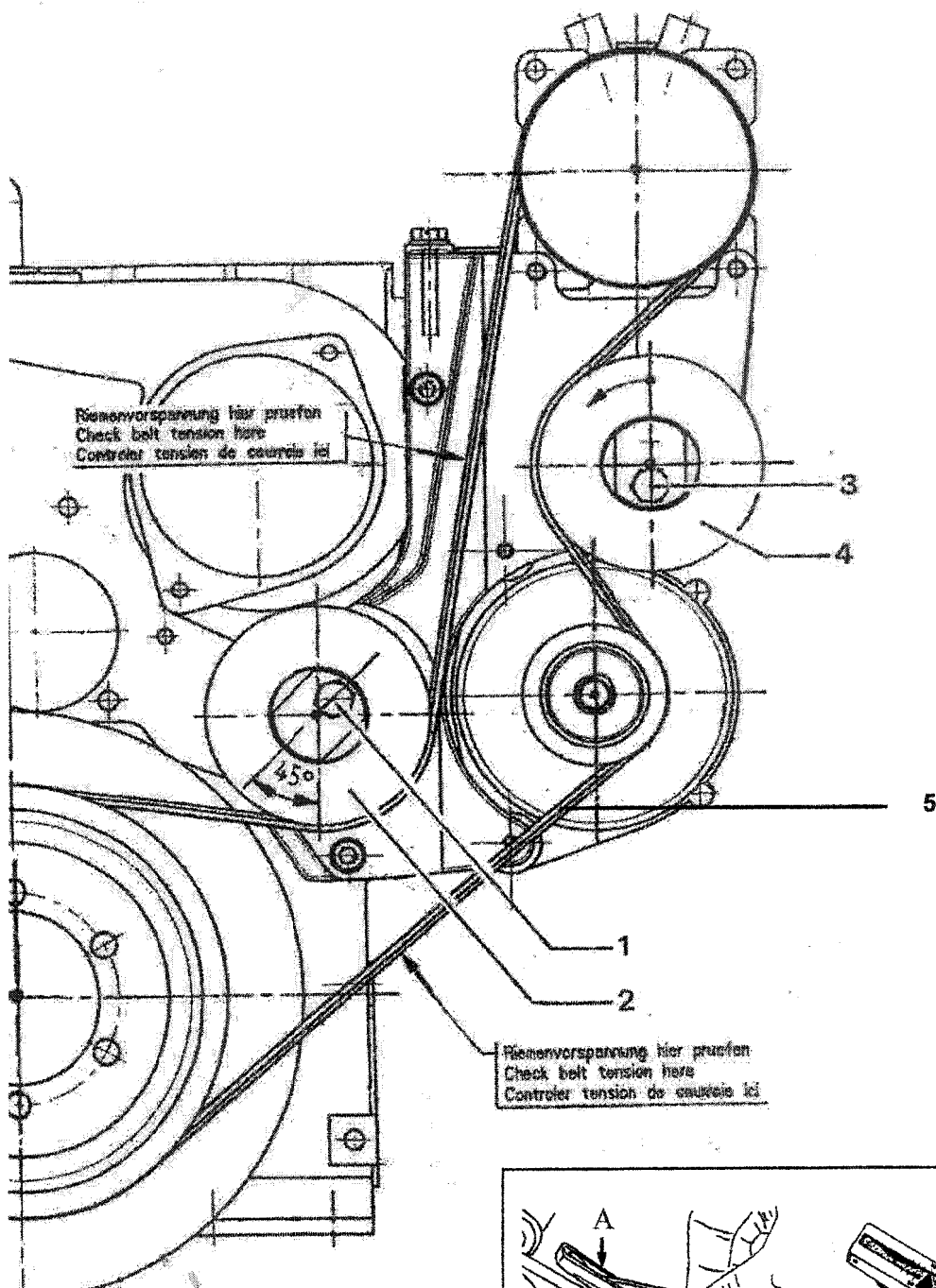
Loosen screw 1 and preset the tension pulley 2 with wrench (SW 36) in counterclockwise direction to 45°. Tighten screw 1. Loosen screw 3 and during the tension pulley 4 with wrench (SW 36) in counterclockwise direction until the correct V-belt tension is reached. Tighten screw 3. Check the V-belt tension again.

### Change V-belt:

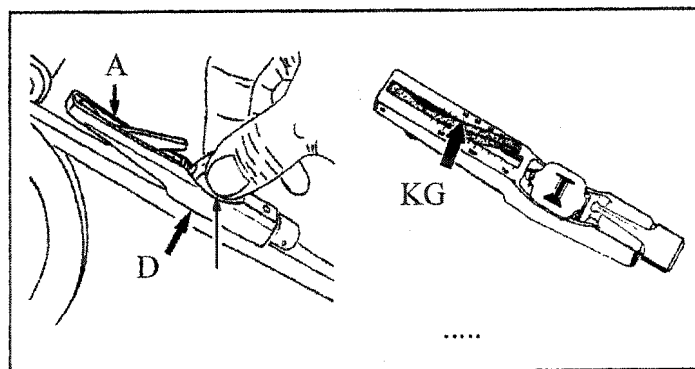
Loosen screws 1, 3 and turn the tension pulley 2, 4 with wrench (SW 36) in clockwise direction. Remove the V-belt 5. Place a new V-belt 5 and adjust it. Tighten everything again.

### Important:

Let new V-belt 5 run-in about 15 - 20 minutes. Recheck the tension and retension, as necessary.



- 1 Screw
- 2 Tension pulley
- 3 Screw
- 4 Tension pulley
- 5 V-belt



**LIEBHERR**

Benennung / Description /  
Denomination

Typ  
Model  
Type

D 924 / 926

Datum / Edition /  
Date  
12 / 2003

Air conditioner compressor and alternator

Blatt  
Page  
Feuille

33.1

## 33.2 Air conditioner compressor and alternator

From engine No. 2000 01 0070

### Check the V-belt tension:

#### Check by hand:

The V-belt 5 is tensioned correctly if it can be pushed down on the given test point with a force of 120 N by 13 mm.

#### Check with "Krikit2" tester, Id.No. 8042829:

Lower the indicator arm A in the test unit, set the test unit on the given test points. Push the button D evenly at a right angle to the V-belt until the spring disengages. Carefully remove the test unit and read the value on the point of intersection of the "KG" scale and the indicator arm A.

Compare the test value with the chart.

V-belt	New V-belt KG scale	Run-in V-belt KG scale
8 grooves approx. 28 mm wide	50	40 - 50

### Adjustment:

Loosen screw 1 and turn the tension pulley 2 with a ratchet according to DIN 3122 D 12,5 ( $\frac{1}{2}$ ") in counterclockwise direction to 45°.

Tighten screw 1.

Loosen screw 3 and during the tension pulley 4 with a ratchet according to DIN 3122 D 12,5 ( $\frac{1}{2}$ ") in counterclockwise direction until the correct V-belt tension is reached.

Tighten screw 3.

Check the V-belt tension again.

### Change V-belt:

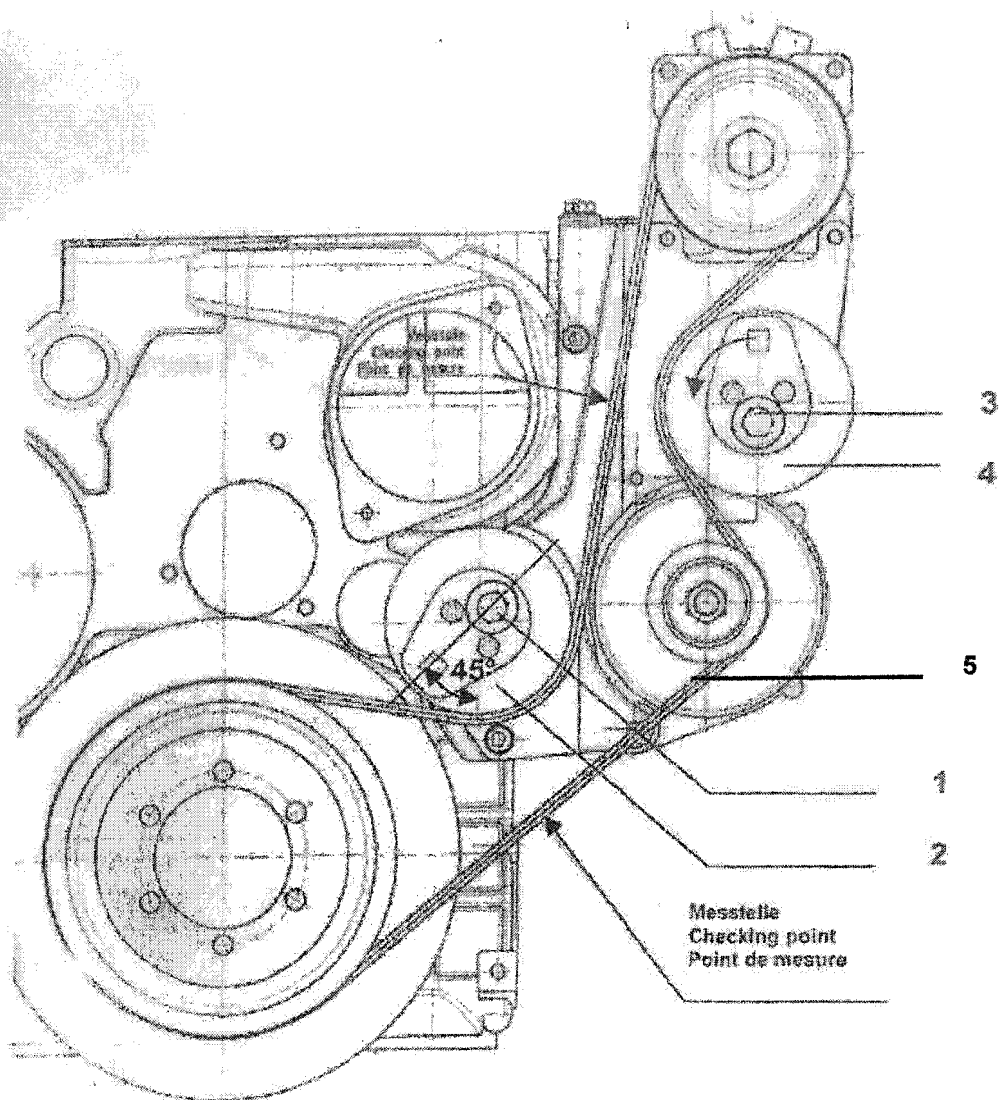
Loosen screw 1,3 and turn the tension pulleys 2,4 with a ratchet according to DIN 3122 D 12,5 ( $\frac{1}{2}$ ") in clockwise direction.

Remove the V-belt 5.

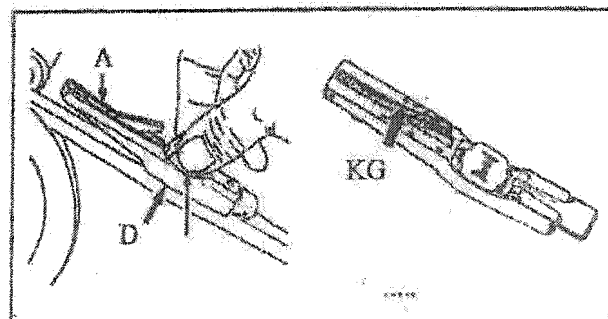
Place a new V-belt 5 and adjust it. Tighten everything again.

### Important:

Let new V-belt 5 run-in about 15-20 minutes. Recheck the tension and refension, as necessary.



- 1 Screw
- 2 Tension pulley
- 3 Screw
- 4 Tension pulley
- 5 V-belt



**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description /  
Denomination

**Air conditioner compressor and alternator**

Typ  
Model  
Type

**D 924 / 926**

Blatt  
Page  
Feuille

**33.2**



### **33.3 Air conditioner compressor and alternator (Dayco-tensioning-device)**

**Note:**

This drive is self-tensioning and therefore maintenance free. The V-belt 2 only has to be checked for wear.

**To change the V-belt:**

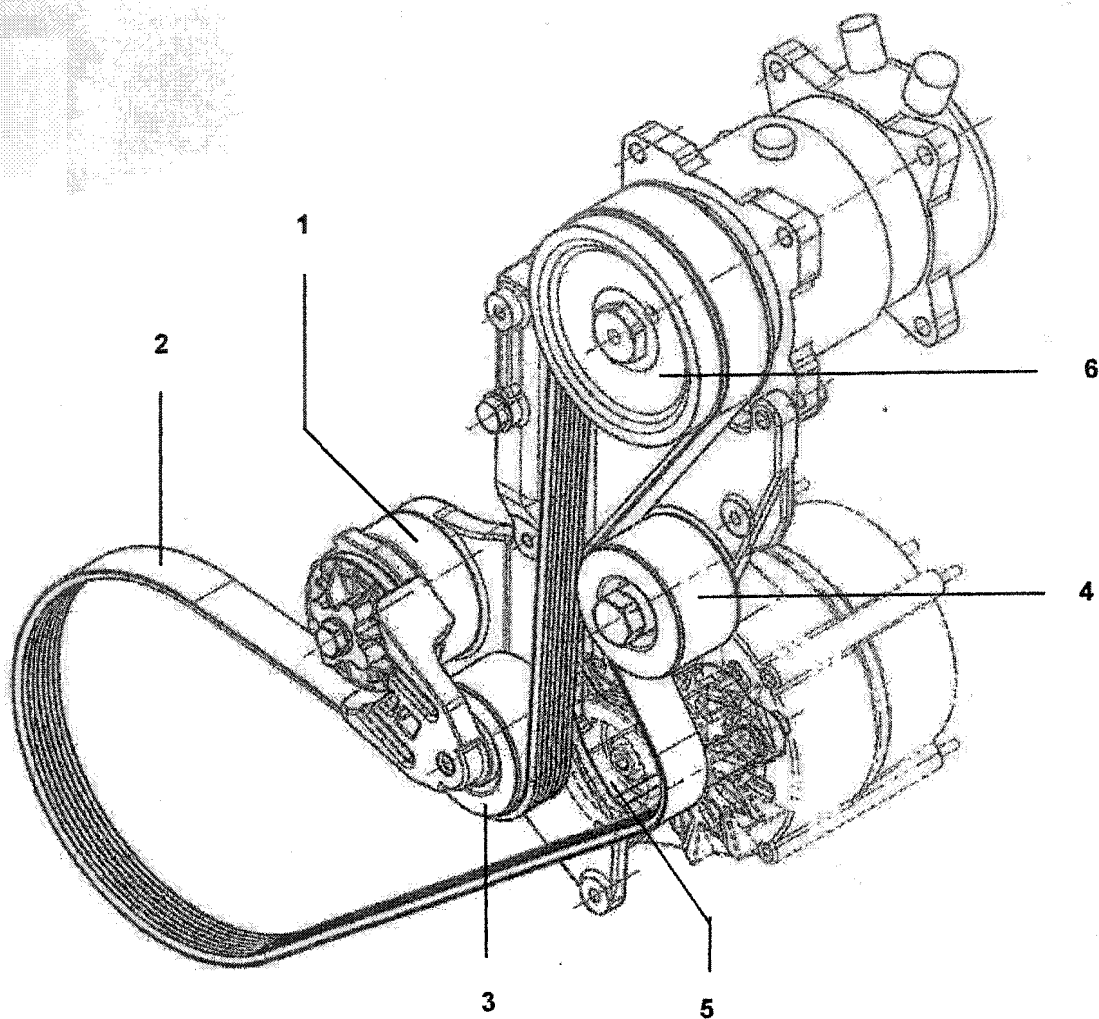
Insert the ratched according to DIN 3122 D 12,5 ( $\frac{1}{2}$ " ) into the square hole on the tensioning device 1. Move the tensioning device 1 moved back against the spring force in counterclockwise direction to the stop and remove V-belt 2.

With the tensioning device 2 moved back, place a new V-belt 2 onto the pulleys of crankshaft, air conditioner compressor 6, alternator 5 and deflection pulley 4 and return the tensioning device 1 again to tensioned position.

**Note:**

When changing the V-belt 2, check the tension pulley 3 and deflection pulley 4 for easy movement and play.

Replace defective tension pulley 3 and deflection pulley 4.



1. Tension device
2. V-belt
3. Tension pulley
4. Deflection pulley
5. Pulley-alternator
6. Pulley-air conditioner compressor

**LIEBHERR**

Benennung / Description / Denomination

Air conditioner compressor and alternator

Typ  
Model  
Type

D 924 / 926

Blatt  
Page  
Feuille

33.3

Datum / Edition /  
Date  
12 / 2003

## **34 Starting aid - flame glow system**

To improve the starting ability, a flame glow system or a heating flange (see page 34.3) is installed as a standard installation on all engines.

### **Function-flame glow system:**

In pre-glow position, the solenoid valve 7 is opened and at the same time, current flows to the flame glow plug 8. During the starting procedure, Diesel fuel is drawn from the fuel tank 1 via the fuel pre-filter 5 by the fuel pump 2 and is directed via the fuel fine filter 6 to the injection pump 3. From the injection pump 3, fuel reaches the heating coil of the flame glow plug 8 via the opened solenoid valve 7. The passing airflow ignites the fuel and is warmed up before getting into the engine. The engine starts quicker in cold ambient temperatures.

### **Note:**

If a control unit is installed in the machine, then it takes over the function or the monitoring of the flame glow system in connection with an engine temperature sensor.

The control unit is not functioning above an engine oil temperature of + 20°C (68° F) .

### **Check:**

#### **Check the solenoid valve:**

Remove the fuel line on the flame glow plug 8. On the injection pump 3, set the shut off lever to "Stop". Turn the engine with the starter, fuel must flow from the fuel line. Bring the shut off lever on the injection pump 3 from Stop to normal position and start the engine, the fuel flow on the lines must stop.

### **Note:**

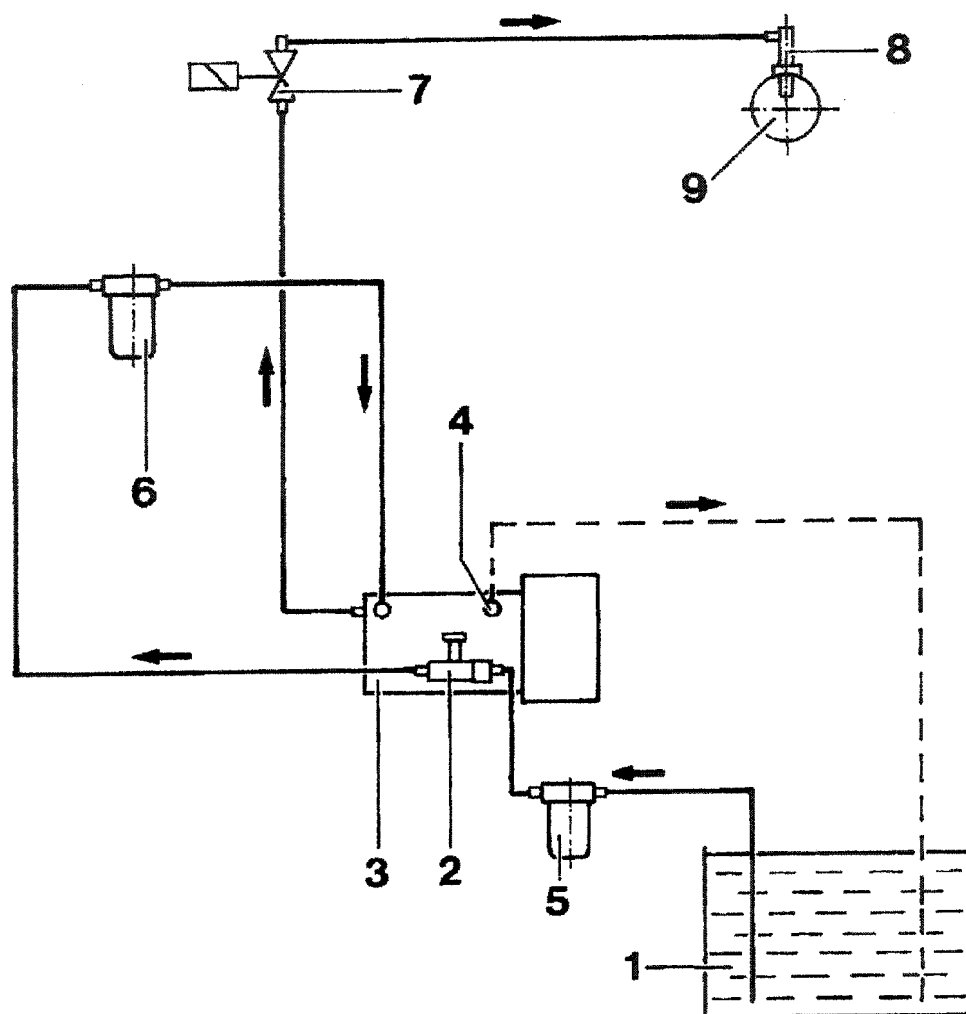
If no fuel emerges when the engine is turned, or if the fuel flow does not stop when the engine is running, then the solenoid valve 7 must be changed. When changing the valve, make sure to note the flow direction, which is marked with an arrow.

#### **Check the flame glow plug:**

Remove the flame glow plug 8 and connect to the fuel line and electrical line. Set the shut off lever on the injection pump 3 to Stop and pre-glow. The heating coil of the flame glow plug 8 must glow red at the end of the pre-glow period. Turn the engine with the starter, the fuel on the glowing heater coil must evaporate.

### **Note:**

If the flame glow plug 8 does not glow red on the heater coil or if no fuel reaches the heater coil when the engine is turned, then the flame glow plug 8 must be replaced.



Blatt 34

- 1 Fuel tank
- 2 Fuel pump
- 3 Injection pump
- 4 Overflow valve
- 5 Fuel pre-filter
- 6 Fuel fine filter
- 7 Solenoid valve
- 8 Flame glow plug
- 9 Suction pipe

— — — — — pressurized  
 - - - - - without pressure

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Starting aid - Flame glow system	Blatt Page Feuille 34

## **34.1 Starting aid - coolant preheating system**

In extremely cold temperatures, a retrofit coolant preheating system can be installed on all engines, in addition to the standard flame glow system, or heating flange.

### **Function:**

The coolant fluid is warmed up by a immersion heater 1 and due to gravity, it will start to circulate in the engine.

A preheated engine will start easier.

### **Installation on the engine:**

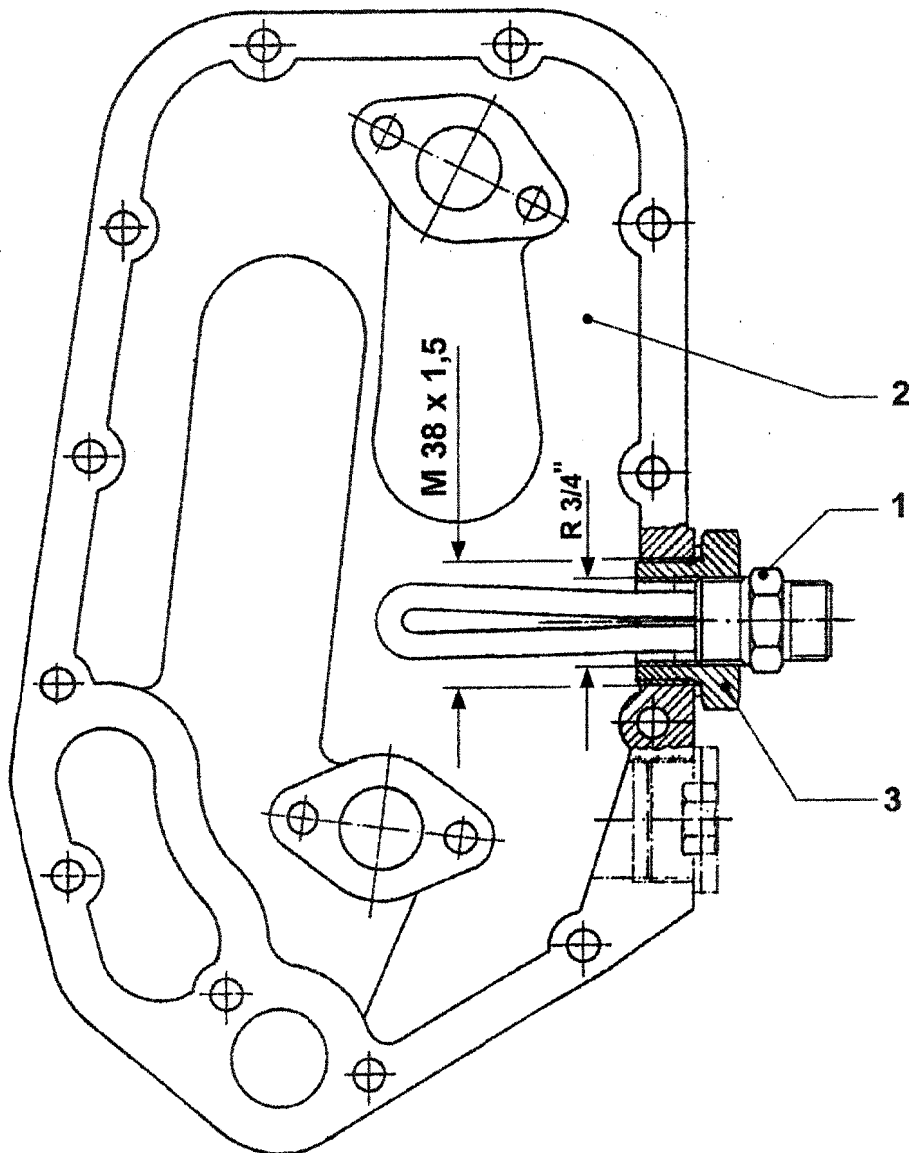
#### **Note:**

Depending on the engine model, there might already be a connector closed off with a plug on the cooler plate 2.

If no connection is available, then the cooler plate 2 has to be replaced with a plate with a connection for the immersion heater 1.

Drain the coolant and remove the plug from the cooler plate 2. Apply sealing compound Omnivisc 1050 to the threads on the reducer fitting 3 and install. Also apply sealing compound Omnivisc 1050 to the threads of the immersion heater 1 and install.

Connect the electrical connections and add coolant.



1000W/240V  
1000W/120V

Blatt 34-1-1

- 1 Immersion heater
- 2 Cooler plate
- 3 Reducer fitting

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Starting aid – Coolant preheating system	Blatt Page Feuille 34.1

## **34.2 Starting aid - oil preheating system**

In addition to the standard flame glow system or heating flange and the retrofit coolant preheating system, an oil preheating system can be installed on the engines.

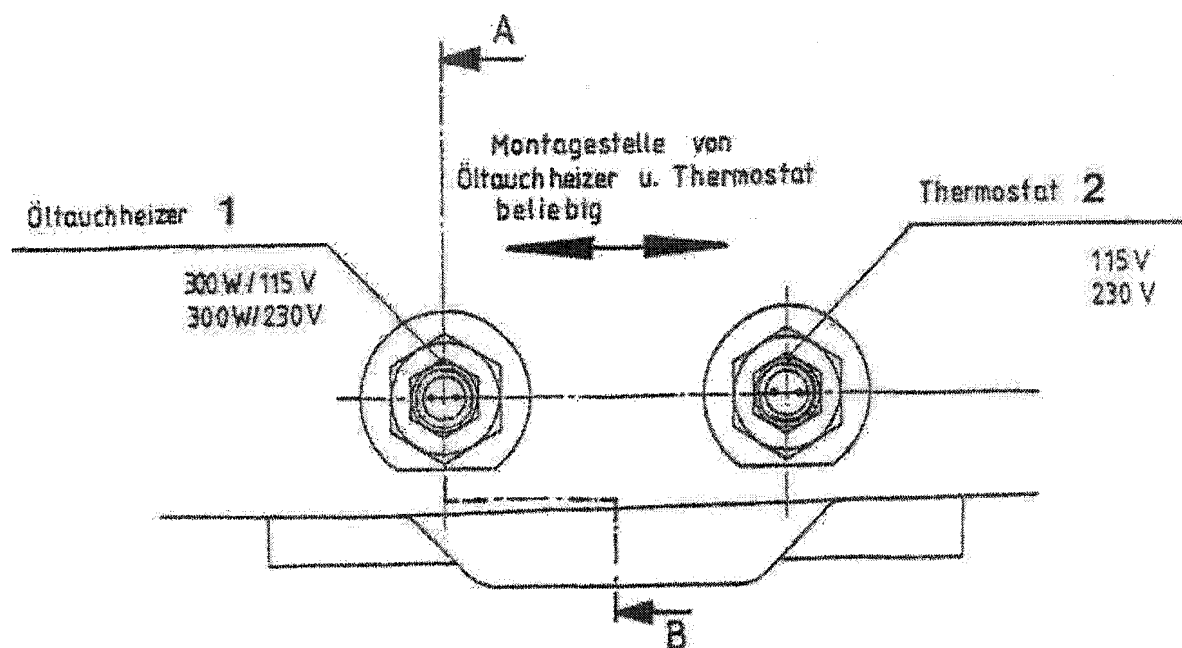
### **Function:**

The oil preheating system consists of an oil immersion heater 1 and a thermostat 2. The thermostat 2 opens at approx. 76°C and stops the current supply to the oil immersion heater 1. If the oil temperature drops to approx. 38 °C, the thermostat 2 closes, the current supply is reestablished and the engine oil is warmed up. Due to this regulation, the engine oil is not heated up too much, preventing carbonization.

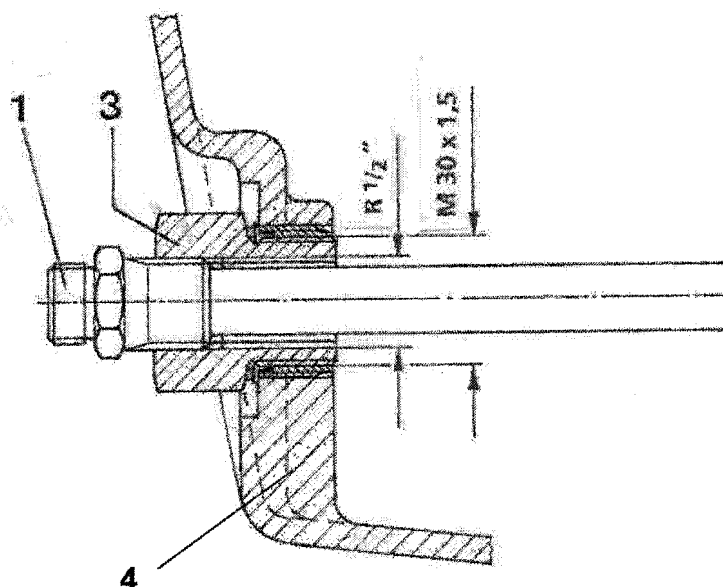
### **Installation on the engine:**

Replace the standard oil pan 4 (if connections are not available) with an oil pan 4 with connections for the immersion heater 1 and thermostat 2. Apply sealing compound Omnivisc 1050 to the threads of the two reducer fittings 3 and install. Apply sealing compound also to the threads of the oil immersion heater 1 or the thermostat 2 and install.

Connect the electrical connections and add engine oil.



Schnitt A-B



- 1 Immersion oil heater
- 2 Thermostat
- 3 Reducer fittings
- 4 Oil pan

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ Model Type D 904 / 914 / 924 D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Starting aid – Oil preheating system	Blatt Page Feuille 34.2



### 34.3 Starting aid – heating flange

To improve the cold start capacity same types of engines are equipped with a heating flange 1 instead of a flame glow system.

The heating flange 1 is integrated into the air intake manifold.

#### Function:

In position preliminary heating, the heating flange 1 is loaded with current and the heating coil 2 begin to glow.

By starting the engine the intake air cross the heating coil 2 and will be supplied warmed to the engine.

The engine can start easily by cold temperatures.

#### Technical data:

Nominal voltage:  $U = 24\text{ V}$

Nominal power after 50s on 24 V: 1,9 kW +/- 10%

Resistance (Ohm): 250 +/- 10% by 20° (68°F)

#### Checking:

Disconnect the cable on the heating flange 1.

Connect on the poles 5 the Ohmmeter or multimeter and check the resistance.

If the heating element 1 is intact, the resistance must have values shown in the specification technical characteristics, otherwise the heating element 1 must be changed.

#### Removal:

Disconnect the cable on the heating element 1.

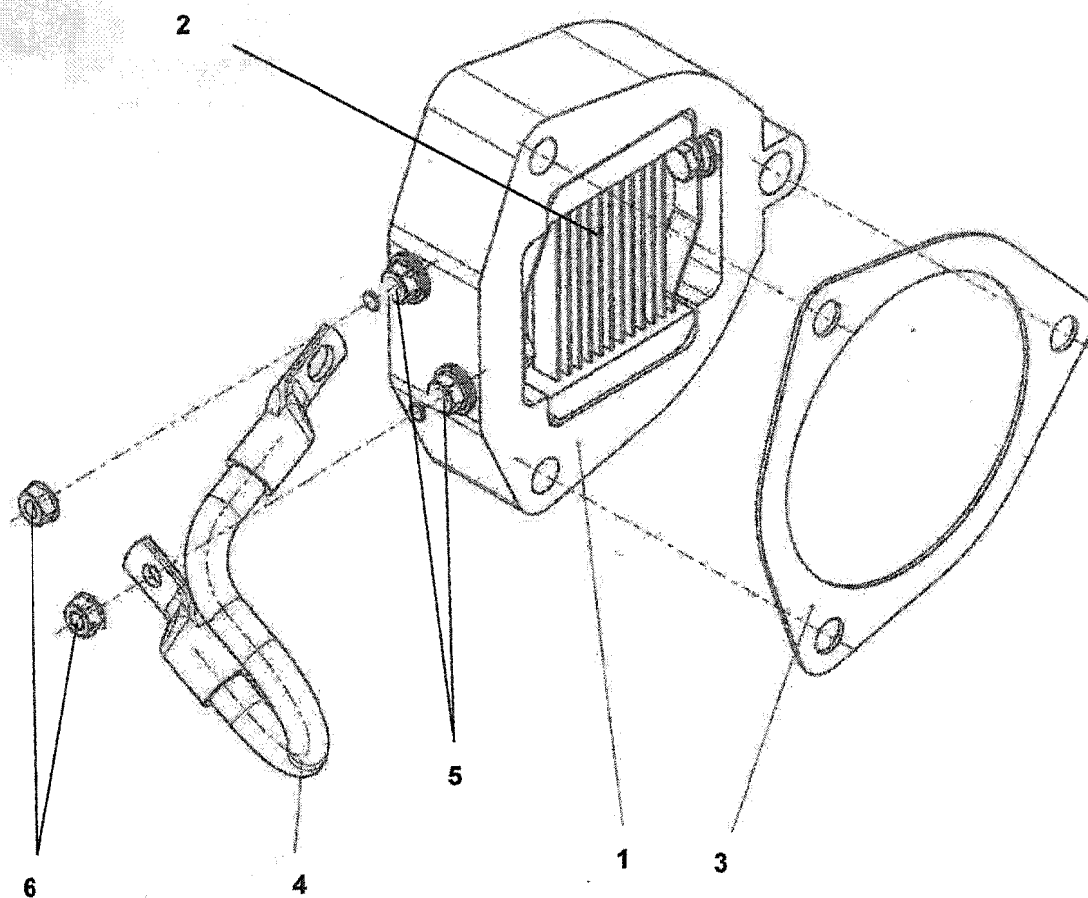
Disengage and unscrew the bolts by counter holding the nuts. Remove the heating element 1 from the suction pipe (manifold).

Clean careful the joint surface. Don't drop part fragments into the suction pipe.

#### Installation:

Install heating flange 1 with new gaskets 3, mount the screws and nuts and tight.

Connect the electric cable.



- 1 Heating flange
- 2 Heater coil
- 3 Gasket
- 4 Earth cable
- 5 Electric connection
- 6 Nuts

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

Starting aid –  
Heating flange

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page 34.3  
Feuille

## 35 Turbocharger

Turbochargers made by Kühnle, Kopp and Kausch (KKK) and Schwitzer are installed on the engines.

Turbocharger made by KKK	Type = K 27, K 29
Turbocharger made by Schwitzer	Type = S 3A, S 2B

D 904 TB / T	= K 27, S 2B
D 906 TB / T / TI	= K 27
D 914 T / TI	= K 27
D 916 T	= K 27, K 29
D 916 TI	= K 27, K 29, S 3A
D 926 TI	= K 29, S 3A
D 924 T / TI-E	= K 27
D 926 T / TI-E	= K 29

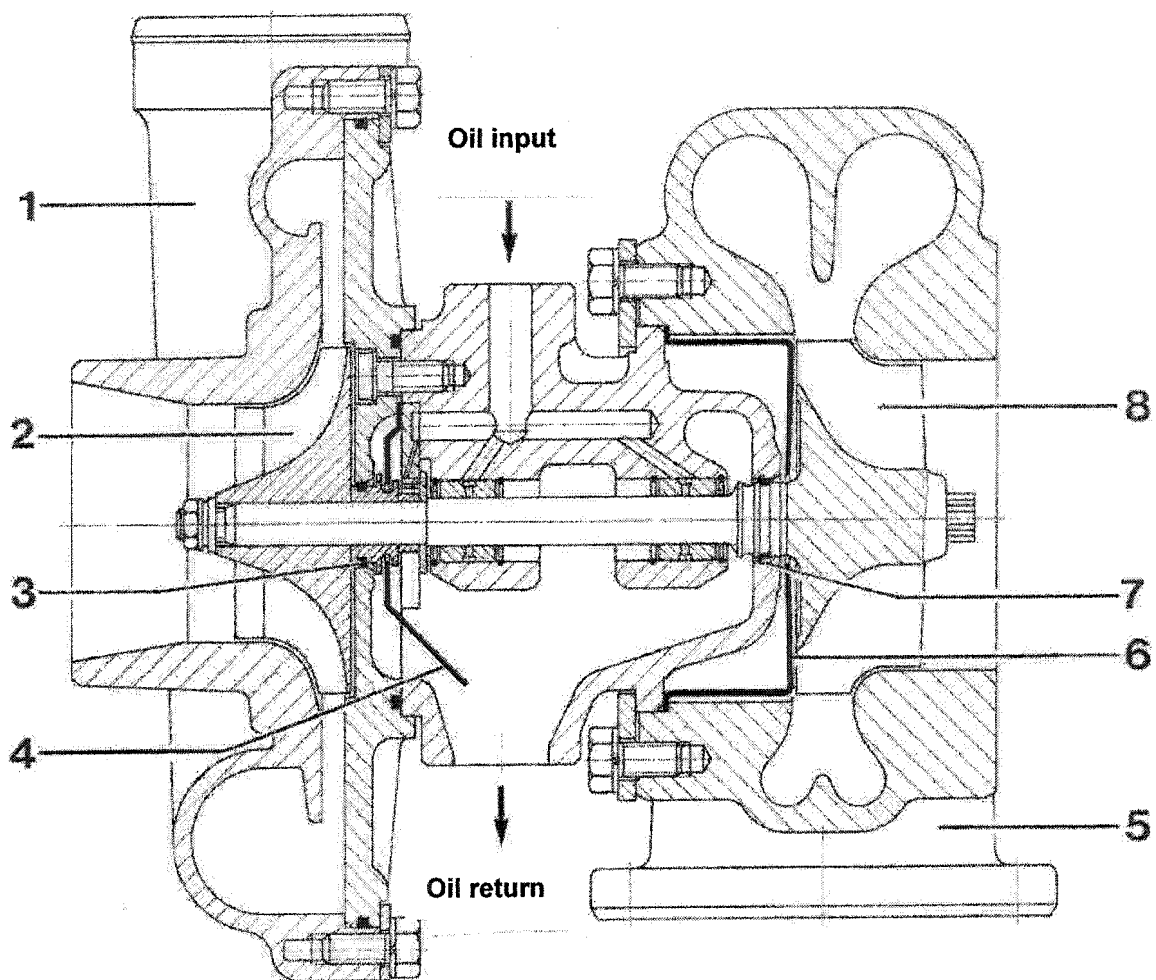
Charging system	: Impulse charge
Charging pressure	: 0.6 to 2 bar, depending on engine model

### Removal and installation:

Remove the lube oil supply line and the lube oil return line. Remove the exhaust line to the muffler and the line from the air filter. Remove the air line to the intake manifold or to the charge air cooler. Remove the screws on the exhaust pipe and remove the turbocharger. To determine the data and bearing plays, see page 35.1, 35.2, 35.3, 35.4. Install in reverse order.

### Note:

Before installing the lube oil supply line, add clean engine oil into the bearing housing.



- 1 Condenser housing
- 2 Condenser wheel
- 3 Piston ring
- 4 Oil deflector
- 5 Turbine housing
- 6 Heat guard
- 7 Piston ring
- 8 Rotor

**LIEBHERR**

Datum / Edition /  
Date  
12 / 2003

Benennung / Description / Denomination

**Turbo charger**

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page  
Feuille 35

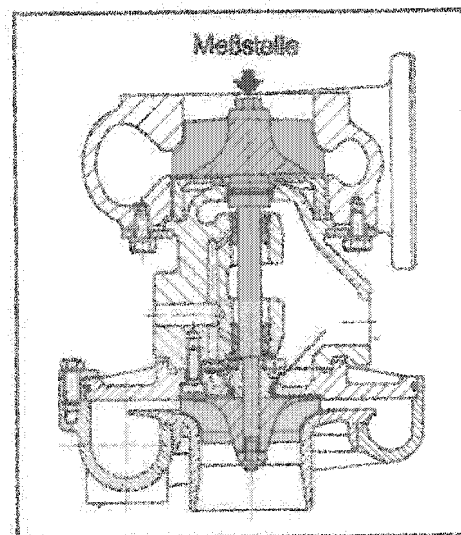
## Determination of bearing plays

Turbo charger - KKK (Kühnle, Kopp & Kausch)

### 1. Axial play measurement

- Set the test point of the gauge on the front of the turbine wheel hub.

Fig. 1.1



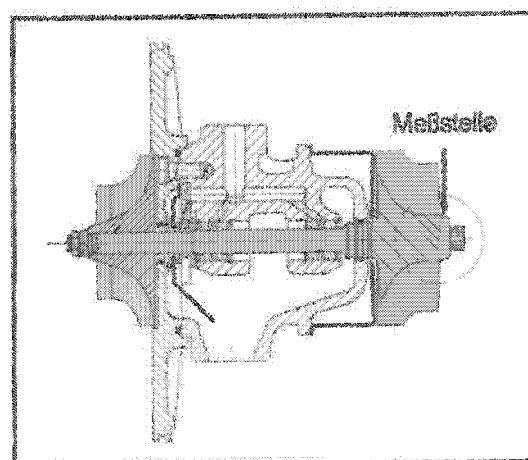
1.1

- Push the rotor down and set the test gauge to „0“!
- Push the rotor against the test gauge and note the deflection of the pointer.
- The permissible axial plays are noted on the data page.

### 2. Radial play measurement

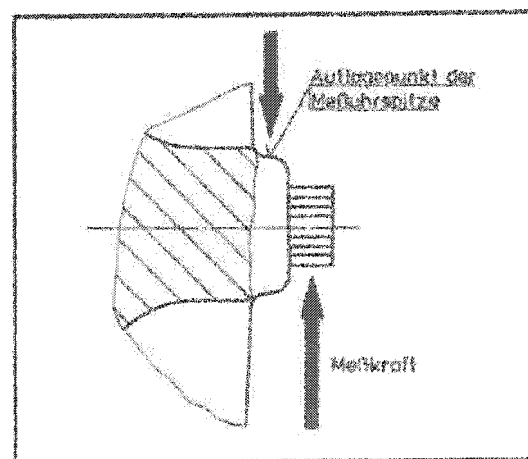
- The determination of the radial play is only needed for the turbine side.
- Set the test point of the test gauge in the center of the intake cone of the turbine wheel.

Fig. 2.1, 2.2



2.1

- Pull the turbine wheel hub with a spring scale down. Test force: 50 N. Set test gauge to "0".
- Pull the turbine wheel hub with a spring scale down. Test force: 50 N
- Note the deflection of the pointer.
- Repeat this measurement, with the rotor turned by 90°.
- The permissible radial plays are noted on the data page.



2.2

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Turbo charger

Typ  
Model  
Type

D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille

35.1

# Data page

Turbo charger - KKK (Kühnle, Kopp & Kausch)

## 1. Tightening torque Nm

Size			K14 /K16	K24	K26	K27	K28	K29	
Part									
SW 10 /12 mm self locking M6	Warm tightening momentum	—	5 <sup>+2</sup>				—	—	
	Tightening momentum	—	12 <sup>+1</sup>				—	—	
SW 10 / 12 mm M6	Warm tightening momentum	—	7 <sup>+2</sup>				—	—	
	Tightening momentum + turning angle	—	5 + 60° -5°				—	—	
SW 14 mm M6	Warm tightening momentum	—	7 <sup>+2</sup>				—	—	
	Tightening momentum +	—	5 + 60° -5°				—	—	
SW 15 mm M7 (links)	Warm tightening momentum	—	7 <sup>+2</sup>				—	—	
	Tightening momentum +	—	5 + 60° -5°				—	—	
SW 10 mm M5	Warm tightening moment	5 <sup>+2</sup>	—				—	—	
	Tightening momentum	6 <sup>+0,5</sup>	—				—	—	
ack wall mounting Without washer			—	8				—	
Back wall mounting With washer			6	10				—	
Condenser housing			7				—	—	
Turbine housing (M 6)			8				—	—	
Turbine housing (M 8)			20				—	—	

## 2. Axial play in mm

Size	K14 / 16	K24	K26	K27	K28	K29	
max. play	0.10	0.16				—	

## 3. Radial play in mm

Size	K14 / 16	K24	K26	K27	K28	K29	
max. play	0.35	0.40		0.43			

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Turbo charger

Typ Model Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Blatt Page Feuille  
35.2

# Determination of bearing plays

## Turbo charger – Schwitzer

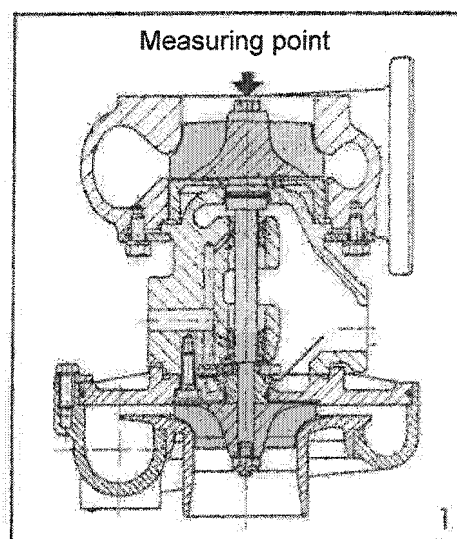
### Axial play measurement:

Set the test point of the test gauge on the front of the turbine wheel hub.

Push the rotor down and set the dial gauge to "0"!

Push the rotor against the dial gauge and note the deflection of the pointer.

The permissible axial plays are noted on the data page.



### Radial play measurement:

The radial play needs to be determined only on the condenser side.

Set the pointer of the dial gauge in the center of the hex nut of the condenser wheel.

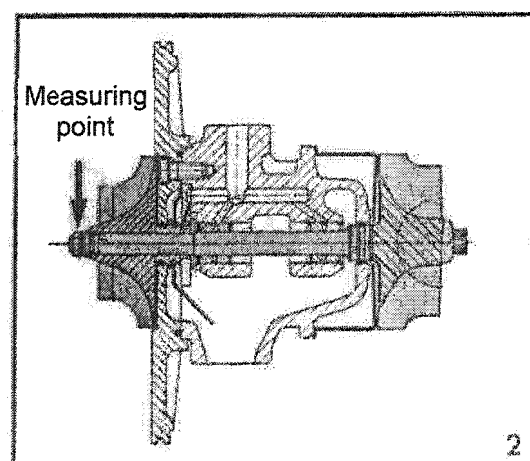
Pull the condenser wheel hub with a spring scale down. Test force: 50 N. Set the dial gauge to "0"!

Pull the condenser wheel hub with a spring scale up. Test force: 50 N.

Note the deflection of the pointer.

Repeat this test, turn the rotor by 90°.

The permissible radial plays are noted on the data page.



**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Turbo charger

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Blatt  
Page 35.3  
Feuille

## Data page

### Turbo charger - Schwitzer

#### Axial play in mm

Size	S 1A	S 1B	S 2A	S 2B	S 3A	S 4T
max. play	0.14				0.17	0.20

#### Radial play in mm

Size	S 1A	S 1B	S 2A	S 2B	S 3A	S 4T
max. play	0.61	0.51	0.82	0.95	0.70	0.72

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Turbo charger	Blatt Page Feuille	35.4



## 36 Gear drive

(Coolant pump installed on timing case)

Turning direction viewed from fan side onto the engine.

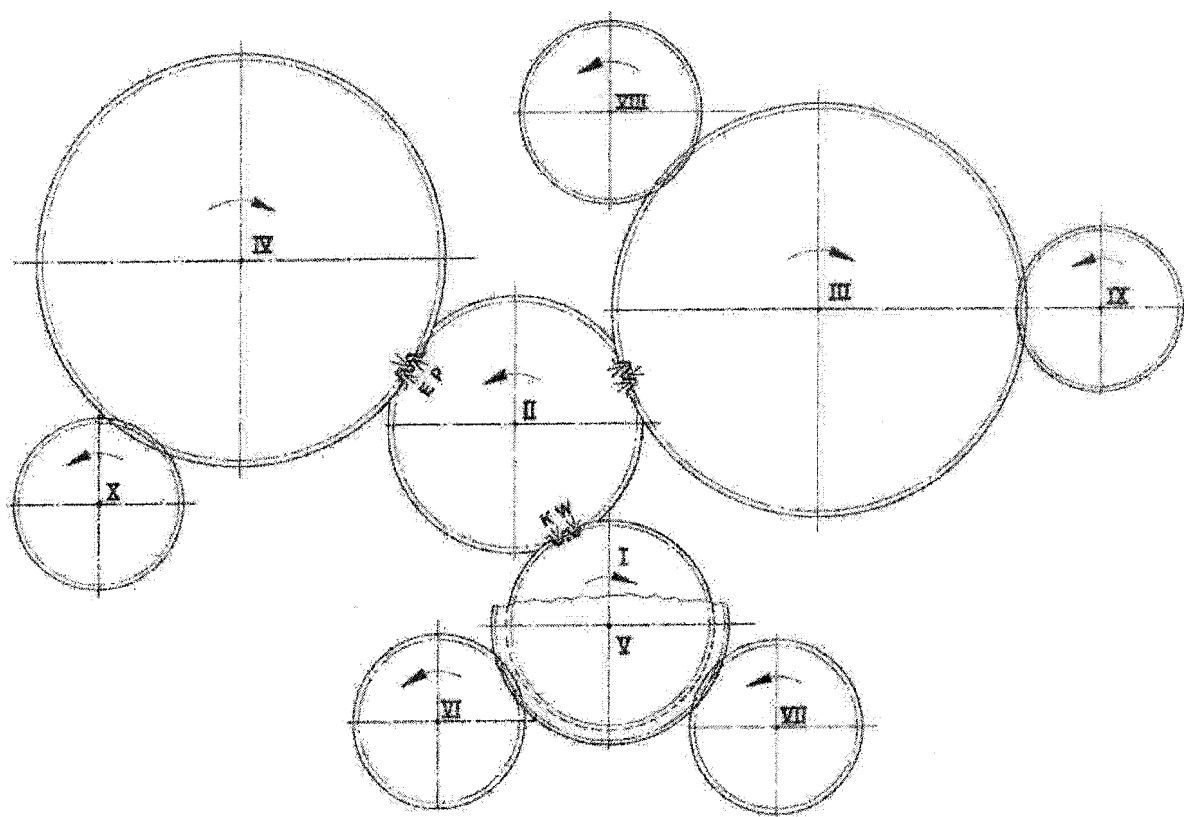
- |      |                               |
|------|-------------------------------|
| I    | Crankshaft gear               |
| II   | Intermediate gear             |
| III  | Camshaft gear                 |
| IV   | Gear - Injection pump drive   |
| V    | Gear - Lube oil pump drive    |
| VI   | Gear - Lube oil pressure pump |
| VII  | Gear - Lube oil suction pump  |
| VIII | Gear - Coolant pump           |
| IX   | Gear - Air compressor         |
| X    | Gear - Hydraulic pump drive   |

### **Important:**

When working on the gear drive, note the gear markings!

### **Description of gear markings on intermediate gear II:**

EP	= Einspritzpumpe = injection pump
KW	= Kurbelwelle = crankshaft



**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

**Gear drive**  
(coolant pump installed on timing case)

Typ  
Model  
Type

**D 904 / 914**  
**D 906 / 916**

Blatt  
Page  
Feuille

**36**

## 36.1 Gear drive

(Coolant pump integrated in timing case)

Turning direction viewed from fan side onto the engine.

I	Crankshaft gear
II	Intermediate gear
III	Camshaft gear
IV	Gear - Injection pump drive
V	Gear - Lube oil pump drive
VI	Gear - Lube oil pressure pump
VII	Gear - Lube oil suction pump
VIII	Gear - Coolant pump
IX	Gear - Air compressor
X	Gear - Hydraulic pump drive
XI	Gear for fan drive on camshaft
XII	Gear - Fan drive
XIII	Gear - Fan drive

### **Note:**

The fan drive can differ, depending on the engine model.

Version A: Gear III and gear XIII.

Version B: Gear XI and gear XII

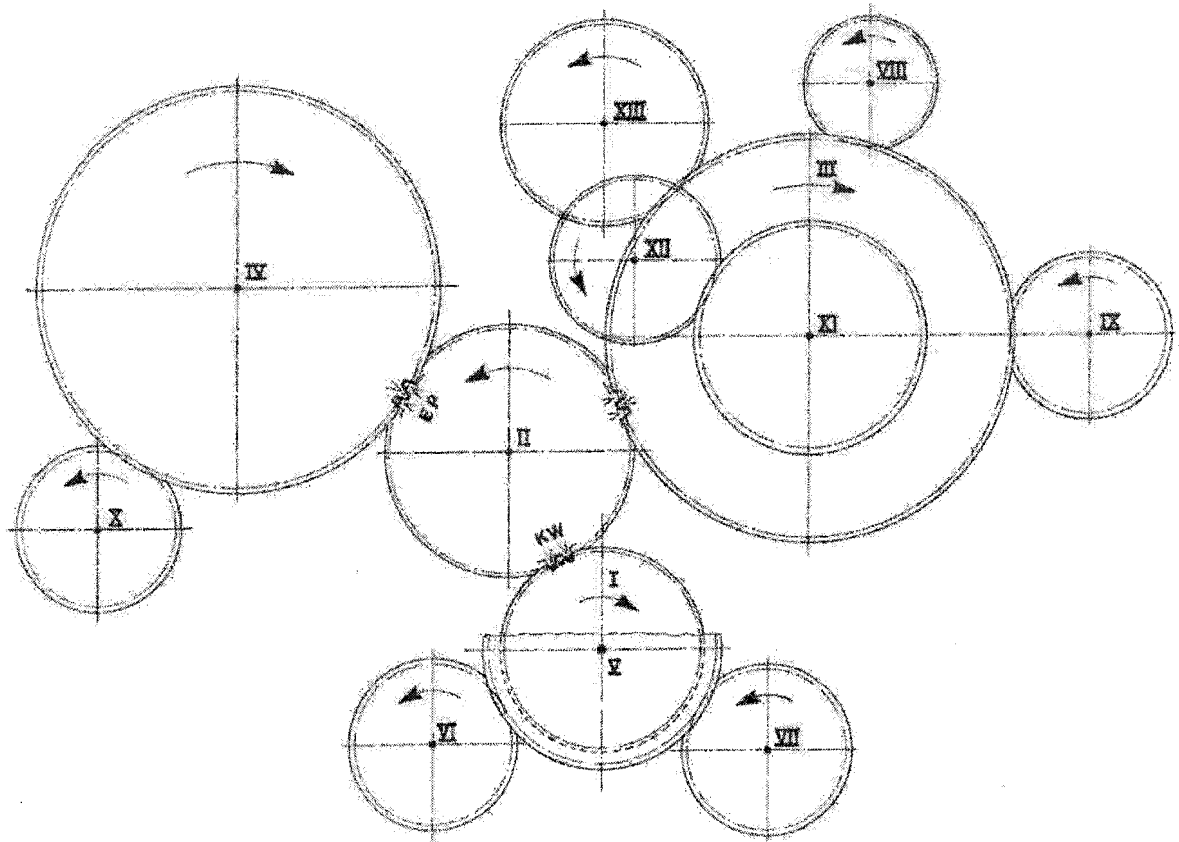
Gears XI, XII and XIII can be sized differently, depending on the RPM design.

### **Important:**

When working on the gear drive, note the gear markings!

### **Description of gear markings on intermediate gear II:**

EP = Einspritzpumpe = injection pump  
KW = Kurbelwelle = crankshaft



**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Gear drive  
(coolant pump integrated in timing case)

Typ  
Model  
Type

D 904 / 914  
D 906 / 916

Blatt  
Page  
Feuille

36.1

## **37 Maintenance and inspection**

The Maintenance and inspection chart shows all necessary maintenance tasks. These tasks are described in detail in the Operation and Maintenance Manual.

Optimum maintenance ensures engine operation without problems and long service life.

	Daily maintenance Every 50 - 100 hrs. Also every 500 hrs. (at least 1x annual) Also every 1000 hrs. Also every 2000 hrs. Also every 3000 hrs. Also every 2 years	Work to be carried out				Check	Clean	Replace	Adjust	Interval Hrs. / Years	D 904 / 906 NA / TB	D 904 / 906 / 914 / 916 / 926 T / TI	D 924 / 926T - E A1	D 924 / 926 T / TI - E As, A3, A4, A5	Page No.
Maintenance	<input type="radio"/>				Check engine oil level	<input type="radio"/>				daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	<input type="radio"/>				Check coolant level	<input type="radio"/>				daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	<input type="radio"/>				Visual inspection (contamination, damage)	<input type="radio"/>				daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	<input type="radio"/>				Air filter - vacuum indicator	<input type="radio"/>				daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	<input type="radio"/>				Water separator on fuel filter	<input type="radio"/>	<input type="radio"/>			daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	24, 24.1
	<input type="radio"/>	<input type="radio"/>			Fuel tank-drain water and sediments (at least 1x per week) wöchentlich)		<input type="radio"/>			50-100	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	<input type="radio"/>	<input type="radio"/>			Dust collector on air filter		<input type="radio"/>			50-100	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>			Engine brake	<input type="radio"/>				500		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>			Check oil, coolant, fuel system for leaks, condition	<input type="radio"/>				500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>			Radiator, pressure relief valve, fan	<input type="radio"/>	<input type="radio"/>			500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>			Water filter (if installed)			<input type="radio"/>		500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	19
		<input type="radio"/>			Corrosion inhibitor / antifreeze, DCA 4 (in case of water filter installation)	<input type="radio"/>				500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	38
		<input type="radio"/>			Engine oil (first at 500 hrs.) important: see : 38			<input type="radio"/>		500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	38
		<input type="radio"/>			Lube oil filter			<input type="radio"/>		500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	17, 17.1
		<input type="radio"/>			Battery and cable connections	<input type="radio"/>				500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
			<input type="radio"/>		Fuel fine filter (or in case of drop in engine performance)			<input type="radio"/>		1000			<input type="radio"/>		24.1.
			<input type="radio"/>		Fuel pre-filter (or in case of drop in engine performance)			<input type="radio"/>		1000			<input type="radio"/>		24.1.
			<input type="radio"/>		Fuel pre-filter-screen (or in case of drop in engine performance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		1000	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	
			<input type="radio"/>		Fuel pre-filter (or in case of drop in engine performance)			<input type="radio"/>		1000	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	24
			<input type="radio"/>	<input type="radio"/>	Fuel fine filter (or in case of drop in engine performance)			<input type="radio"/>		2000	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	24
			<input type="radio"/>		Grease gear on flywheel	<input type="radio"/>		<input type="radio"/>		1000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
			<input type="radio"/>		Mounting of oil pan and engine brackets	<input type="radio"/>				1000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>	<input type="radio"/>		Check air intake and exhaust system-for leaks, condition (first after 500 hrs.)	<input type="radio"/>				1000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
					Air filter main element (according to maintenance indicator / annually )			<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
					Air filter safety element (at every 3rd change of the main element / annually ) never clean!			<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
				<input type="radio"/>	Coolant with corrosion inhibitor / antifreeze			<input type="radio"/>		2 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	38
Check and Adjustment		<input type="radio"/>			Tension + condition of V-belt (alternator)	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	500	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>			Tension + condition of V-belt (air conditioner compressor)	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	500			<input type="radio"/>	<input type="radio"/>	33, 33.1, 33.2, 33.3
		<input type="radio"/>			Valve play	<input type="radio"/>			<input type="radio"/>	500		<input type="radio"/>			6
		<input type="radio"/>	<input type="radio"/>		Valve play (1. Adjustment at 500 hrs.)	<input type="radio"/>			<input type="radio"/>	1000	<input type="radio"/>				6
			<input type="radio"/>		Valve play	<input type="radio"/>			<input type="radio"/>	1000			<input type="radio"/>	<input type="radio"/>	6, 6.1
			<input type="radio"/>		Engine regulation (engine RPM)	<input type="radio"/>			<input type="radio"/>	1000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
			<input type="radio"/>		Flame glow plug (at begin of cold season)	<input type="radio"/>	<input type="radio"/>			1000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	34
				<input type="radio"/>	Injector valve (or in case of drop in engine performance)	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	3000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27, 27.1 20.1, 20.2,
				<input type="radio"/>	Coolant pump (first at 6000 hrs.)	<input type="radio"/>		<input type="radio"/>		3000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	20.3
				<input type="radio"/>	Oil separator			<input type="radio"/>		2 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	28, 28.1

△ First and only maintenance interval

○ Repeat interval

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

Maintenance and inspection

Typ  
Model  
Type

D 904 / 914  
D 906 / 916

Blatt  
Page

37

## Service fluids

### Lube oils

#### Lube oil quality

Only highly alloyed lube oils are used for today's modern Diesel engines. They consist of base oils with additives

The lube oil guidelines for Liebherr Diesel engines is based on the following specifications and guidelines.

API - Classification : CG-4, CF-4, CH-4

(American Petroleum Institute)

ACEA (CCMC) - Classification : E2-96 (D4), E3-96 (D5), (D4, D5), E4-98, E5-99  
(Association des Constructeurs Européens de l'Automobile)

Naturally aspirated engines	CG-4, CF-4, CH-4, E2-96 (D4)
Turbo charged engines	CG-4, CF-4, CH-4, E2-96 (D4), E3-96 (D5), E4-98, E5-99

#### Lube oil viscosity

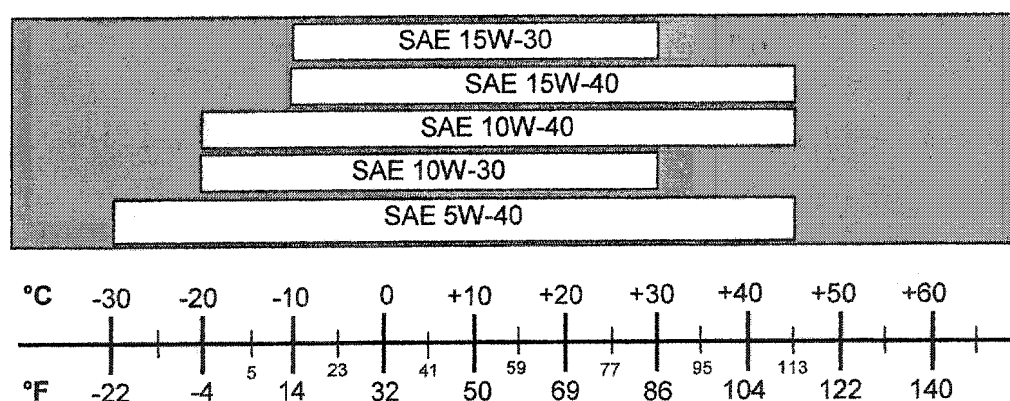
To classify the lube oil viscosity, SAE classification (Society of Automotive Engineers) is used.

The deciding factor for the correct selection of SAE classification is the ambient temperature.

The selection of the SAE classification provides no information about the quality of the lube oil.

If the viscosity is too high, starting difficulties may arise, if the viscosity is too low, the lubrication efficiency may be endangered.

The temperature ranges shown in the chart below are guidelines and can be exceeded or fallen below for a short time.



**LIEBHERR**

Benennung / Description / Denomination

Typ D 904 / 914 / 924  
Model D 906 / 916 / 926  
Type

Datum / Edition / Date  
12 / 2003

**Service Fluids**

Blatt  
Page  
Feuille 38

## Oil change intervals

First oil change at 250 respective 500 working hours when using oils according to specification. Filter changes interval every 500 working hours. Further oil changes according to climatic zones, sulfur content in the fuel and oil quality according to table below.

When using E3-96 (D5), E4-98, E5-99 oils in naturally aspirated engines, the interval of 500 hours may be exceeded.

If these operating hours are not reached within one year, then the engine oil and filters should be changed at least once a year.

INTERVALS IN OPERATING HOURS		Naturally aspirated engine	Turbocharged engine	
Working conditions	Sulfur content in fuel	Oil quality	Oil quality	
		CH-4	CH-4	
		CG-4	CG-4	E3-96
		CF-4	CF-4	(D5)
		E2-96	E2-96	E4-98
		(D4)	(D4)	E5-99
Normal climatic conditions	up to 0.5%	500 hrs.	250 hrs.	500 hrs.
up to -10°	0.5% or higher	250 hrs.	125 hrs.	250 hrs.
below -10°C	up to 0.5 %	250 hrs.	125 hrs.	250 hrs.
	0.5 % or higher	125 hrs.	-	125 hrs.

## Coolant

To provide protection from corrosion in the cooling system, the coolant must contain at least 50 % corrosion inhibitor / antifreeze all year round. This mixture provides protection from freezing to approx. -37°C.

In case any coolant is lost, it must be ensured that the 50 % ratio is retained.

Do not use more than 60 % corrosion inhibitor / antifreeze, a higher percentage will actually reduce the cooling efficiency and antifreeze protection.

Check the ratio of the coolant during maintenance checks. Change the fluid at least once every 2 years.



## Coolant with DCA 4 (DCA 4 = Diesel coolant additives)

The coolant must contain at least 50 % corrosion inhibitor / antifreeze all year round. This protects to approx. -37°C.

If coolant is lost, it has to be ensured that the percentage never drops below 50%.

**Important:** Do not use more than 60% corrosion inhibitor / antifreeze, a higher percentage would actually reduce the cooling effect and antifreeze protection.

The mixing ratio of corrosion inhibitor, antifreeze and the DCA 4 concentration must be checked during maintenance work (every 500 hrs. ) and must be corrected, if necessary.

The DCA 4 concentration must be between 0.3 – 0.8 units per liter.

To check, we recommend the test kit CC 2602 M by Fleetguard.

The coolant must be changed every 2 years.

Before adding new coolant, check the cooling system for cleanliness, clean if necessary.

### To fill the cooling system

To fill or refill the cooling system after repairs, liquid DCA 4 must be added to the corrosion inhibitor / antifreeze in addition to the DCA 4 concentration already contained in the water filters.

Cooling system contents	Required quantity DCA 4 liquid			DCA 4 Water filter	
	Liter	Container @ 0.5 Liter	Liter	Description	Id. No.
24 - 39		3	or 1,4	WF 2071	7367045
40 - 59		4	or 1,9	WF 2072	7381493
60 - 79		5	or 2,4	WF 2073	7367052
80 -115		8	or 3,8	WF 2073	7367052

### Water filter change intervals

Water filter change intervals every 500 hrs.

If no coolant has been lost in the cooling system, the DCA 4 concentration in the cooling system should be sufficient if the water filter is changed every 500 hrs.

### Use of DCA 4 without corrosion inhibitor / antifreeze

In exceptional cases and if ambient temperatures are always above freezing, for example in tropical areas and where no approved corrosion inhibitors / antifreeze fluids are available, water + DCA 4 may be used as coolant.

To protect the cooling system from corrosion in that case, twice as much DCA 4 must be used as compared to the usual mixing ratio of corrosion inhibitor / antifreeze fluid.

The DCA 4 concentration must be between 0.6 – 1.06 units per liter.

The DCA 4 concentration must be checked during maintenance work (every 500 hrs.), correct as necessary.

**The coolant must be changed once a year.**

Check the cooling system for cleanliness before adding coolant, flush the system, if necessary.

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Service Fluids	Blatt Page Cover	38.1

### Fresh water guidelines:

When preparing the coolant, use water, which is not too hard. Often, but not always, drinking water can be used. Sea water, brackish water, brine and industrial waste water are not suitable.

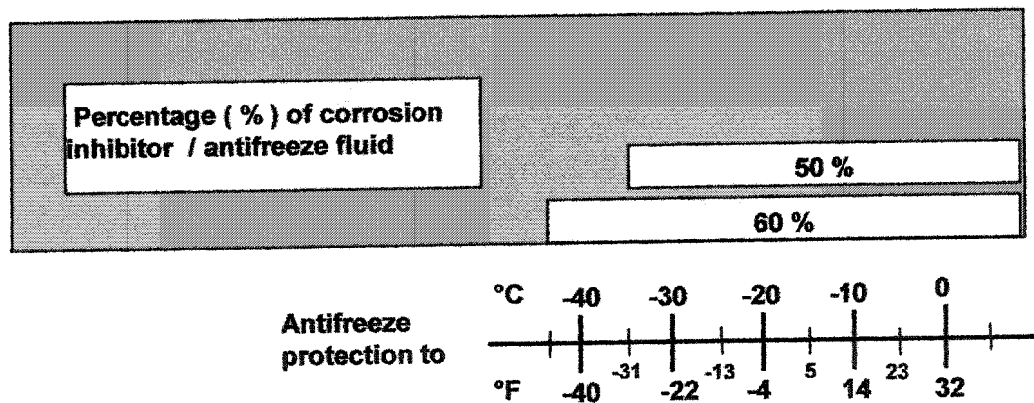
### Fresh water quality when using corrosion inhibitors / antifreeze fluid:

Sum of alkaline earths (Water hardness):	06 to 3.6 mmol/dm <sup>3</sup> (3 to 20° d)
Ph- value at 20°C:	6.5 to 8.5
Chloride / ion content:	max. 80 mg/dm <sup>3</sup>
Sulfate / ion content	max. 100 mg/dm <sup>3</sup>

### Fresh water quality when using coolant with DCA 4:

Sum of alkaline earths (Water hardness):	0.6 to 2.7 mmol/dm <sup>3</sup> (3 to 15° d)
Ph- value at 20°C:	6.5 to 8.0
Chloride / ion content:	max. 80 mg/dm <sup>3</sup>
Sulfate / ion content	max. 80 mg/dm <sup>3</sup>

### Mixing ratio of corrosion inhibitors and antifreeze fluids



Do not use more than 60 % corrosion inhibitor / antifreeze fluid, a higher percentage will actually reduce the cooling efficiency and antifreeze protection.

## Approved corrosion inhibitors / antifreeze fluids

Brand	Manufacturer
<b>Agip</b> Antifreeze Plus Agip-Auto Langzeit-Frostschutz Antigel DB 486 Aral Antifreeze Extra Aral Antifreeze T Avia Antifreeze APN	Agip Petrol S.p.A Rom Italien Agip Schmiertechnik GmbH, Würzburg Sotragal SA, St. Priest / Frankreich Aral GmbH, Bochum Aral GmbH, Bochum Deutsche Avia Mineralöl GmbH, München
<b>BP</b> Antifrost X 2270 A BP Nappel C 2270/1	Deutsche BP AG, Hamburg BP Chemicals LTD., London / England
<b>DEA</b> Kühlerfrostschutz DEUTZ Kühlerschutzmittel 0101 1490 DOW Kühlmittel D 542 / 1993	DEA Mineraloel AG / Hamburg DEUTZ Service International GmbH, Köln BOSS Chemie AG, Wittenbach / Schweiz
<b>Frostschutz</b> 600	Mobil Schmierstoff GmbH, Hamburg
<b>Glacelf</b> SX Glyco Shell Glysantin (G 48-00)	Elf Lubrifiants Paris / Frankreich Shell Chemie GmbH, Eschborn BASF AG, Ludwigshafen
<b>Igol</b> Antigel Type DB	Igol France, Paris / Frankreich
<b>Motul</b> Anti-Freeze	Motul SA, Aubervilliers Cedex/ Frankreich
<b>ÖMV</b> - Kühlerfrostschutzmittel OZO Frostschutz S	ÖMV AG, Wien / Österreich Total Deutschland GmbH, Düsseldorf
<b>Total</b> Multiprotect	Total Deutschland GmbH, Düsseldorf

<b>LIEBHERR</b>	Benennung / Description / Denomination	Typ	D 904 / 914 / 924
		Model Type	D 906 / 916 / 926
Datum / Edition / Date 12 / 2003	Service Fluids	Blatt Page Feuille	38.2

## **Diesel fuels**

Diesel should meet the minimum requirements of the approved fuel specifications. The sulfur content should not exceed 0.5 % of the total volume.

A higher sulfur content affects the oil change intervals and the engine service life.

### **Viscosity**

Due to the reduction of sulfur content, the viscosity of the Diesel fuel was in question. It has been shown that Diesel fuels with the limit valid for Europe of max. 0.05 % sulfur content can cause wear in injection systems (especially in distributor injection pumps).

„Brand name fuels“ (in Germany) contain additives as part of their additive package. The fuel viscosity according to HFRR (60°) test must be < 400 µm.

This additive should be added by the supplier as part of his responsibility for quality control. We do not recommend adding secondary lubricity additives by the customer.

### **Diesel fuel for very low temperatures**

At ambient temperatures of less than 0°C, the flow capacity of the standard warm weather Diesel fuel might become insufficient due to paraffin excretion. The same applies for cold season Diesel fuel below - 15°C.

Often Diesel fuels with additives are offered for an operating temperature to - 20°C.

To prevent operating problems in even lower temperatures, Diesel fuel must be mixed with regular gasoline or petroleum.

Adding regular gasoline should be considered a temporary measure and may not exceed 30 % of the total volume.

Super gasoline may not be used for mixture.

These cold season additives can influence the engine output, depending on the additive. For that reason, add as little as possible, just enough for that particular ambient temperature range.

For safety reasons, mix any fuel additives only in the fuel tank.

When refueling, fill the specifically lighter fuel before refueling the Diesel fuel. Then run the Diesel engine until the two types of fuel are spread throughout the fuel system.

For mixing ratio, see chart.

### Diesel fuel additives (flow improvers)

Commercially available flow improvers can also significantly improve Diesel fuel in cold temperatures. Observe the instructions issued by the manufacturer regarding dosage and application.

#### Approved fuel specifications:

DIN EN 590  
ASTM D 975 - 89a 1 D and 2

Please consult Diesel engine development for additional fuel specifications.

### Dieselskraftstoffe - Mischungsverhältnis (Vol.-%)

Ambient temperature °C	Summer Diesel fuel %	Additive %	Winter Diesel fuel %		Additive %	
			- 15°C	- 20°C	- 15°C	- 20°C
0 to -10	70	30	100	100	-	-
-10 to -15	50	*50	100	100	-	-
-15 to -20	-	-	70	100	30	-
-20 to -25	-	-	50	70	*50	30

\* If addition of more than 50 % is necessary, use only petroleum (not normal gasoline) .

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

Benennung / Description / Denomination

**Service Fluids**

Typ  
Model  
Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Blatt  
Page  
Feuille  
38.3

## Troubleshooting

Problem	Cause	Remedy
<b>1) The engine does not start</b>	Fuel tank is empty	Fill fuel tank and bleed fuel system
	Fuel pre-cleaner is clogged	Clean filter
	Fuel filter is clogged, due to paraffin separation in winter	Replace the fuel filter and bleed the fuel system, use winter fuel
	Fuel lines leaking	Check line connections for leaks and tighten screw fittings
	Starter defective	Remove and have starter tested or repaired in repair shop
	Battery run down	Check and charge battery
	Electrical connections on battery, starter or ignition are loose	Check and tighten cable
	Flame start system is defective (at low temperatures)	Check solenoid valve and flame glow plug, replace if necessary
<b>2) Engine starts briefly, then stops again</b>	Check all problems listed under point 1, except electric and flame start system	See point 1
	Vent in fuel tank cover is clogged	Clean cover
<b>3) Engine runs erratically, fails periodically or power is reduced</b>	Check all problems listed under point 1+ 2, except electric and flame start system	See point 1 + 2
	Air filter contaminated	Clean air filter
	Exhaust flap for engine brake is closed or jammed	Check position of exhaust flap
	Overflow valve on injection pump outlet does not maintain pressure	Check and replace, if necessary

Problem	Cause	Remedy
	Valves in fuel pump leak	Check fuel pump in repair shop or replace, if necessary
	Charge air cooler dirty	Clean charge air cooler
	Charging pressure too low	Check turbocharger
	Begin of delivery of injection pump not correct	Check begin of delivery, adjust if necessary
	Fuel injectors get stuck or do not atomize	Check fuel injectors, adjust or replace
	Injection pump, flow quantity not correct or regulating rod is stuck	Have injection pump checked in pump repair shop
	Throttle control rod is not on full load stop	Have rod checked or adjusted
	Engine compression too low	Replace valves, piston and cylinder, if necessary
<b>4) Exhaust emissions are black</b>	Air filter is contaminated	Clean air filter
	Leaks on intake system	Check hoses or lines or replace
	Exhaust flap for engine brake is closed or gets stuck	Check the position of the exhaust flap
	Fuel injectors are damaged or dirty	Check fuel injectors, adjust or replace
	Begin of delivery of injection pump is not correct	Check begin of delivery, adjust as necessary
	Flow quantity of injection pump is too large	Have injection pump checked in repair shop
<b>5) Exhaust emissions are blue</b>	Lube oil level in engine is too high	Correct oil level
	Lube oil gets into the combustion chamber and is burnt. Play between valve shaft and valve guides is too large, piston rings are worn, broken or stuck, wear on piston and cylinder liners	Overhaul cylinder heads or replace, change piston and cylinder liners
	Gasket on compression side of turbocharger is defective	Check turbocharger, replace, as necessary

## Troubleshooting

Problem	Cause	Remedy
6) Exhaust emissions are white	Cylinder head gasket is defective and coolant penetrates into the combustion chamber	Replace the cylinder head gasket
	Cylinder head cracked or leaks	Replace the cylinder head
7) Engine knocks rapidly	Fuel injectors leak or do not properly spray fuel	Check and adjust fuel injectors, replace as necessary
	Begin of delivery of injection pump incorrect	Check begin of delivery, adjust as necessary
8) Engine knocks	Fuel injectors are damaged or dirty	Check and adjust fuel injectors, replace as necessary
	Piston rings are worn or broken, piston worn	Check piston and cylinder liner and replace, as necessary
	Main or connecting rod bearing is defective	Install new engine bearing or repair
9) Coolant temperature too high	Not enough coolant in cooling system	Add coolant
	Air in cooling system	Bleed cooling system
	Radiator dirty on the outside	Clean cooling system
	Radiator internally dirty or calcified	Decalcify radiator
	Thermostats defective	Check thermostats, replace as necessary
	Coolant pump defective	Check coolant pump, repair or replace as necessary
	Fan defective	Check fan, replace as necessary
10) Lube oil pressure too low	Oil level in oil pan is too low	Add oil to the correct mark
	Lube oil too thin	Drain oil, add specified oil
	Oil pressure gauge or the pressure sensor is defective	Check the oil pressure and replace the damaged sensor or pressure gauge

**LIEBHERR**

Benennung / Description / Denomination

Typ **D 904 / 914 / 924**  
Model **D 906 / 916 / 926**  
Type

Datum / Edition / Date  
**12 / 2003**

**Troubleshooting**

Blatt  
Page **39.1**  
Feuille



<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
	Lube oil pressure pump is defective	Replace lube oil pressure pump
	Relief valve on lube oil pressure pump is blocked in open condition	Check relief valve on lube oil pressure pump, replace as necessary
	Bearing plays are too large due to wear or bearing damage	Overhaul the engine or bearing
<b>11) Lube oil in cooling system</b>	Oil cooler or oil cooler plate leaks	Remove, replace in case of leaks
	Cylinder head gaskets leak	Replace cylinder head gaskets
<b>12) Coolant in lube oil</b>	Cylinder head gaskets leak	Replace cylinder head gaskets
	O-rings on cylinder liners leak	Replace O-rings

## Special tools

For inspections, adjustments, resealing work and repairs

Description	Id. No.	D 904 D 906	D 914 D 916 D 926	D 924-E D 926-E	D 9306 D 9308 D 9406 D 9408
<b>Compression tester</b>	8008782	X	X	X	X
<b>Connector</b> for compression tester	0524044	X	X	X	X
<b>Injector testing device</b>	7361236	X	X	X	X
<b>High pressure hand pump</b> to test and adjust begin of delivery	7009318	X	X	X	X
<b>Retaining device</b> to turn off starting boost	0527462		X	X	X
<b>Test gauge</b> to test and adjust begin of delivery „VE“ – injection pump	7022418			X	
<b>Testing device</b> to test and adjust begin of delivery „VE“ – injection pump	7022420			X	
<b>Intermediate section</b> to test and adjust begin of delivery „VE“ – injection pump	7022419			X	
<b>Light signal</b> to test and adjust „Electronic regulation“	6004308			X	X
<b>Pulling device</b> for fuel injector	0524072	X	X	X	X
<b>Adapter</b> for pulling device – fuel injector	0524029	X	X	X	X
<b>Turning device</b> Installation on flywheel housing	0524045	X	X	X	X

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Benennung / Description / Denomination

Typ  
Model  
Type  
D 904 / 914 / 924  
D 906 / 916 / 926

Datum / Edition / Date  
12 / 2003

**Special tools**

Blatt  
Page  
Feuille  
40

Description	Id. No.	D 904 D 906	D 914 D 916 D 926	D 924-E D 926-E	D 9306 D 9308 D 9406 D 9408
<b>Hand crank</b> for cylinder head, main and connecting rod bearing	0524062	X	X	X	X
<b>Piston ring pliers</b>	7009319	X	X	X	X
<b>Piston ring compression device</b>	8000592	X	X	X	X
<b>Valve fixture</b> to install valves in cylinder head	0524048	X	X	X	X
<b>Dial gauge holder</b> to measure piston clearance	0526856	X	X	X	
<b>Cylinder liner puller</b>	0526855	X	X	X	
<b>Punch</b> to press in crankshaft seals	0524053	X	X	X	
<b>Installation sleeve</b> for crankshaft seal ring on flywheel side	0523460	X	X	X	
<b>Puller</b> for injection pump gear „VE“ injection pump	0541353			X	
<b>Puller</b> for injection pump gear „P“ pump, electronic regulation	0528473			X	X
<b>Puller</b> for injection pump gear on control-sleeve injection pump (H-RP43)	0542220			X	X
<b>Pulling device</b> for coolant pump (coolant pump integrated in timing case)	0542221	X	X	X	
<b>Fixing screw</b> For coolant pump assembly	0542744	X	X	X	
<b>V-belt testing device - Krikit 2</b> to test V-belt tension	8042829	X	X	X	X

**LIEBHERR**

Datum / Edition / Date  
12 / 2003

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D 904 / 914 / 924  
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Blatt  
Page  
Feuille  
40.1